UNCLASSIFIED

CONFORMAL COATINGS FOR PRINTED CIRCUIT ASSEMBLIES

REPORT NO. 2

DA 36-039-sc-89136

SECOND QUARTERLY REPORT

NOV. 1, 1961 TO JAN. 31, 1962

U. S. ARMY SIGNAL SUPPLY AGENCY
STANDARDIZATION ENGINEERING DIVISION
FT. MONMOUTH, NEW JERSEY

MOTOROLA INC.
Military Electronics Division · Chicago Center
1450 NORTH CICERO AVENUE, CHICAGO 51, ILLINOIS

CONFORMAL COATINGS

FOR

PRINTED CIRCUIT ASSEMBLIES

Second Quarterly Report for the period of Nov. 1, 1961 to January 30, 1962.

Signal Corps Contract Number DA-36-039 SC89136

Department of the Army Project Number: 5999-004

Placed by: United States Army Signal Supply Agency
Standards Engineering Division
Materials Section
Fort Monmouth, New Jersey

Contractor: Motorola, Inc.
Chicago Center
1450 N. Cicero Ave.
Chicago 51, Illinois

Signal Corps Contract Number DA-36-039 SC-89136

Technical Requirements for PR & C Number 61-SIMSA-482
dated 22 March 1961.

Dept. of the Army Project Number: 5999-004

Report Submitted by: Anthony J. Beccasio
Anthony J. Beccasio
Project Engineer

Approved by: Robert D Andreasen
Robert Andreasen
Manager, Engineering Services

CONFORMAL COATINGS FOR

PRINTED CIRCUIT ASSEMBLIES

Second Quarterly Report for the period of Nov. 1, 1961 to January 30, 1962.

Objective: Phase A: Evaluate commercially available conformal coating materials used as protective coatings on printed circuit boards in order to obtain data for the preparation of a three services coordinated military specification which will provide sufficient physical, mechanical and electrical properties to assure satisfactory performance of printed circuit assemblies over long storage periods and under high humidity conditions.

Phase B: Investigate a method of removing the coating from the board to permit replacement of parts when necessary without impairing the functional operations of the unit.

Phase C: Evaluate, for possible upgrading purposes, allowable minimum spacings between conductors on uncoated and coated boards as described in paragraphs 5.1.5 of MIL-STD-275A.

TABLE OF CONTENTS

Appendix

PURPOSE

The purpose of this project is to evaluate commercially available conformal coating materials used as protective coatings on printed circuit boards in order to obtain data for the preparation of a three services coordinated military specification which will provide sufficient physical, mechanical, and electrical properties to assure satisfactory performance of printed circuit assemblies over long storage periods and under high humidity conditions.

In this report, the tasks are defined as follows: -

Task A

Investigation of epoxy resin conformal coatings on XXXP, glass-epoxy and paper-epoxy copper clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phase 1 Two-part epoxy resin coating systems

Part 1 Characteristics of epoxy resin coatings studied.

Part 2 Curing Schedule.

Phase 2 Test Panels used.

Phase 3 Precoating Preparation of Surface

Part 1 Cleaning.

Part 2 Soldering.

Phase 4 Method of Coating Application

Phase 5 Physical and Electrical Properties of Epoxy Resin Coating Systems.

Part 1 Appearance and Adhesion.

Part 2 Thickness measurements.

Part 3 Dielectric Constant and Dissipation Factor of disc specimens.

Part 4 Dissipation Factor and Q-Factor of coated test panels.

Part 5 Dielectric Withstanding Voltage (initial).

Part 6 Thermal cycling.

Part 7 Dielectric Withstanding Voltage (after thermal cycling).

Part 8 Insulation resistance and appearance under moisture conditions.

Part 9 Dielectric Withstanding Voltage (after moisture test).

Part 10 Abrasion Resistance.

Part 11 Ruggedization.

Part 12 Flexibility.

Task B

Investigation of polyurethane resin conformal coatings on XXXP and glass-epoxy, copper-clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phases 1 - 5 The same as Task A where application is feasible.

Task C

Investigation of Silicone-based polymer coatings on glass-epoxy and silicone-glass copper-clad laminate series specified in MIL-P-13949B.

Phases 1 - 5 The same as Task A where application is feasible.

Task D

Investigation of fluorinated resin (FEP) based polymers on teflon-glass and FEP copper-clad laminates per MIL-P-13949B and MIL-P-27538 respectively.

Phases 1 - 5 The same as Task A where application is feasible.

Task E

Investigation of melamine coatings on glass-melamine copper-clad laminate.

Phases 1 - 5 The same as Task A where application is feasible.

Task F

Investigation of MIL-V-173 varnishes on glass-epoxy, XXXP and paper-epoxy laminates per MIL-P-13949B.

Phases 1 - 5 The same as Task A where application is feasible.

ABSTRACT

Task A

Investigation of epoxy resin conformal coatings on XXXP, glass-epoxy, and paper-epoxy copper clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phase 5 Physical and Electrical Properties of Epoxy Resin Coating System

Part 3 Dielectric Constant, Dissipation Factor, and Q Factor

Two-inch-disc specimens were prepared in a similar method described in paragraph 4.3 of MIL-I-16923C. The dielectric constant, dissipation factor and Q Factor of the disc specimens were measured at 1, 3, 6.25, 30, 50, 75, and 100 mc using the resonance-rise method described in ASTM-D-150. It was found that as the frequency increases the dielectric constant decreases. On the other hand, as the frequency increases, the dissipation factor decreases to a minimum between 30 and 50 mc and then increases from 50 to 100 mc.

Part 4 Q Factor and Dissipation Factor of the coated test panels.

The dissipation factor and Q value of the coating was determined, using Specimen X, at 1, 50 and 100 mc by calculating the relative differences of the coated and uncoated boards. It was found that the Q value and dissipation factor changed with increasing frequency and followed the same pattern described in part 3. However at 100 mc, the dissipation factor of epoxy-paper and XXXP is high so that a true Q value and dissipation factor of the coating cannot be readily determined.

Part 6 Thermal Cycling

All epoxy specimens passed five cycles of thermal cycling without any visible deterioration of the coating, printed conductors or base materials.

Part 7 Dielectric Withstanding Voltage, after thermal cycling

All epoxy specimens passed the tests specified in paragraph 4.7.8 of MIL-P-55110 and paragraph 4.4.3.2 of SCL-6225.

Part 8 Insulation Resistance, under moisture conditions

All epoxy specimens passed the minimum resistance values of 1.0 X 10^8 ohms after ten cycles of humidity. However when examined for corrosion of conductors only epoxies C, F and I passed. The other five epoxies exhibited copper conductor corrosion to various degrees.

Part 9 Dielectric Withstanding Voltage, after moisture resistance

All epoxy specimens, except epoxy G, passed the tests specified in para. 4.7.8 of MIL-P-55110 and para. 4.4.3.2 of SCL-6225.

ABSTRACT
(Continued)

Task B

Investigation of polyurethane resin conformal coatings on XXXP, glass-epoxy and paper-epoxy, copper clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phase 5 Physical and Electrical Properties of Polyurethane Resin Coating Systems

Part 3 Dielectric Constant, Dissipation Factor & Q Factor

Two inch disc specimens were prepared from a mold shown in Table X in the Appendix. This spacing was used because of the low solids content of the polyurethane resin coating systems. Difficulty was encountered when measuring the dielectric constant and dissipation factor at 100 mc because of the high capacity of the two inch disc specimens. When a thicker disc specimen was cast, it was found not to cure fully because of solvent entrapment.

Part 4 Q-Factor and Dissipation Factor of the Coated test panels

The dissipation factor and Q value of the coating was determined, using Specimen X, at 1, 50, and 100 mc by calculating the relative differences of the coated and uncoated boards. It was found that the Q value and dissipation factor changed with increasing frequency and followed the same pattern described in Part 3 of Task A. However, at 100 mc, the dissipation factor of epoxy-paper and XXXP is high so that a true Q value and dissipation factor of the coating cannot be readily determined.

Part 6 Thermal Cycling

All polyurethane specimens passed five cycles of thermal cycling without any visible deterioration of the coating, printed conductors or base materials.

Part 7 Dielectric Withstanding Voltage, after thermal cycling

All polyurethane specimens passed the tests specified in paragraph 4.7.8 of MIL-P-55110 and paragraph 4.4.3.2 of SCL-6225.

Part 8 Insulation Resistance, under moisture conditions

All polyurethane specimens passed the minimum resistance values of 1.0 X 10^8 ohms after ten cycles of humidity. However when examined for corrosion of conductors only polyurethanes HH, GG, BB & AA passed. The other polyurethane exhibited copper corrosion to various degrees.

ABSTRACT
(Continued)

Task C

Investigation of silicone-based polymer coatings on glass-epoxy copper clad laminate series specified in MIL-P-13949B.

Phase 1 Silicone base polymer coatings

Part 1 Characteristics of silicone-base polymer coatings

Two silicone-based polymer coating for printed circuits were obtained from two manufacturers. These two coatings met the requirements of para. 2b of PR & C 61-SIMSA-482. The two coatings were of the two component type.

Part 2 Curing Schedule

All silicone coatings were cured at 100°C for 2 hours.

Phase 2 Test Panels Used

Same as discussed in Phase 2 of Task A of Abstract.

Phase 3 Precoating Preparation of Surface

Part 1 Cleaning

Same as discussed in Phase 3 of Task A of Abstract.

Phase 4 Method of coating application

All specimen panels were brush coated.

Phase 5 Physical & Electrical properties of silicone-based polymer coating

A visual check of the two coatings revealed one of the coatings wrinkled after the curing cycle and was rejected from further testing. However the other coating showed no evidence of blistering, wrinkling, cracking and peeling of coating and no corrosion of printed conductors. Both coatings exhibited good adhesion to specimen test panels.

Part 2 Thickness measurements

All specimen test panels were coated to a thickness of 0.012 ± 0.007 inches.

Part 8 Insulation Resistance and appearance under moisture resistance conditions

The coating passed the minimum requirements of 1.0 X 10^8 ohms. However when examined visually there was evidence of copper corrosion.

PUBLICATIONS, LECTURES, REPORTS & CONFERENCES

On November 15 & 16, 1961, the writer visited the Research Laboratories of Minnesota Mining & Mfg. Corp. in St. Paul, Minnesota, to obtain data on the effect of epoxy coatings on printed wiring boards and means of repairing them.

FACTUAL DATA

Phase 1 Two part epoxy resin coating systems

Part 3 Dielectric Constant, Dissipation Factor and Q Factor

(a) Mold - The epoxy coating specimens were cast in a mold similar to one described in paragraph 4.3.1 of MIL-I-16923C except that glass plates were substituted for highly polished steel plates. The size of the cast sheet made was 5 X 5 inches.

(b) 2 inch disc specimen - The mold described in part 3(a) was heated to 75°C. The epoxy coating was mixed according to the manufacturers recommendations, deaired for 10 minutes and poured into the mold. During the pouring process care was taken to avoid the entrapping of air into the material. The coating material was cured at 75°C for 2 hours. A two inch disc was cut from the cast sheet and the thickness of the specimen was measured with a Micrometer to ensure that the two surfaces were parallel to within ± 0.001 inch. The two inch discs were measured at 1, 3, 6.25, 30, 50, 75 and 100 megacycles.

(c) Procedure - The procedure used for measuring dielectric constant and dissipation factor is similar to the one described in ASTM-D-150. In testing these coatings, the resonance rise method was used in conjunction with a micrometer - electrode system.

For frequencies from 20 to 100 mc, Boonton Radio Co. Model 190-A Q - meter Serial No. 1195 was used.

For frequencies below 20 mc, a Boonton Radio Co. Model 260-A Q - meter Serial No. 159 was used. The micrometer - electrode system used was manufactured by General Radio Co. Type 1690 Dielectric Sample Holder Serial No. 472.

The procedure for determining the dielectric constant dissipation factor and Q factor of the coatings is as follows: -

(1) Insert 2 inch disc specimen in between electrode plates of Dielectric Sample Holder and screw top electrode down until it is in contact with specimen.

(2) Resonate Q-meter circuit and note readings C, on capacitance dial and Q_1 reading on voltmeter scale and spacing of electrodes (t_1).

(3) Remove specimen from holder and resonate Q-meter circuit again by bringing electrodes closer together. Record new spacing (t_2) and new Q_2 reading.

FACTUAL DATA
(Continued)

For a 2 inch specimen the unknown capacity (C_x) is

$$C_x = C_2 + \Delta C_2 - \Delta C_1 \quad \text{(Eq. 1)}$$

where C_2 = geometric air capacitance for spacing (t_2)

C_1 = geometric air capacitance for spacing (t_1)

ΔC_2 = correction for setting (t_2) (correction factor for dielectric sample holder)

ΔC_1 = correction for setting (t_1) (correction factor for dielectric sample holder)

The geometric air capacitance (c) for 2 inch disc specimen is obtained from the following formula:

$$C = \frac{706.5}{t} \quad \text{(t = mils or thousands of an inch)}$$

The dielectric constant (K) is calculated as follows: -

$$K = \frac{C_x}{C_1} \quad \text{(Eq. 2)}$$

The Q factor of the coating (Q_x) is calculated as follows: -

$$Q_x = \frac{Q_1 \, Q_2 \, C_x}{(Q_2 - Q_1)\, C} \quad \text{(Eq. 3)}$$

From this the dissipation factor (D_x) is: -

$$D_x = \frac{1}{Q_x} = \frac{C}{C_x}\left(\frac{1}{Q_1} - \frac{1}{Q_2}\right) \quad \text{(Eq. 4)}$$

The dielectric constant and dissipation factor data and graphs for epoxy coating systems appear in the Appendix Table V thru Table VIII.

Part 4 Q-Factor and Dissipation Factor of the coated panels

The Q factor and dissipation factor was determined on the control specimen and coated panels at 1, 50 and 100 mc. These tests were run on Specimen X in lieu of Specimen Y because at higher frequencies, the lead length begins to introduce appreciable error due to lead inductance. Because of this effect, we wanted to keep our lead length from the specimen to the measuring instrument as short as possible so as to reduce this measurement error.

FACTUAL DATA
(Continued)

The procedure used for determining these factors is as follows: -

(1) Resonate Q meter without specimen and note Q_2 (Voltmeter Readings) and C_2 readings.

(2) Place test specimen in Q meter circuit and resonate circuit again and note Q_1 and C_1 readings.

(3) Calculate Q_x of coating as follows: -

$$Q_x = \frac{Q_1 \; Q_2 \; (C_2 - C_1)}{(Q_2 - Q_1) \; C_1} \qquad \text{(Eq. 5)}$$

The dissipation factor can be calculated by using (Eq. 4)

The relative change in the Q of the coating is calculated as follows: -

$$Q_x \begin{pmatrix}\text{of coating} \\ \text{on panel}\end{pmatrix} = \left(Q_x \begin{pmatrix}\text{of uncoated} \\ \text{board}\end{pmatrix} - Q_x \begin{pmatrix}\text{coated} \\ \text{board}\end{pmatrix} \right) \qquad \text{(Eq. 6)}$$

The data for these above mentioned readings is listed in Appendix, Table IX.

FACTUAL DATA
(Continued)

Part 6 Temperature Cycling

The epoxy test specimens were subjected to five cycles, of temperature cycling test described in Method 102A, Cond. D of MIL-STD-202.

Part 7 Dielectric Withstanding Voltage, after thermal cycling

All dielectric withstanding voltage tests were made on a Motorola built - Breakdown tester TE-8359 with output from 0 to 3000 v AC at 60 cps. Specimen X was electrified at 1500 V AC for 30 seconds and Specimen Y electrified at 1000 V AC for 1 minute.

Part 8 Insulation Resistance under moisture conditions

The epoxy specimens were subjected to 14 cycles of humidity according to Method 106 of MIL-STD-202. During the humidity cycling, 100 volts DC was applied to Specimen Y and 500 volts applied to specimen X. Insulation resistance measurements were taken initially and after the first, fifth, seventh, tenth and fourteenth cycles in accordance with Method 301 of MIL-STD-302. Prior to measurement, Specimen Y test patterns were electrified for one minute at 100 volts and specimen X test patterns were electrified at 500 volts for one minute. Insulation resistance measurements were taken with the test specimens maintained at 25°C and 90-95% relative humidity. A photograph of the test set-up is shown in the Appendix, p. xvii and the measurements are shown in the Appendix, Page xix.

Part 9 Dielectric Withstanding Voltage, after moisture resistance

All dielectric withstanding voltage tests were made on a Motorola built - Breakdown tester TE-8359 with output from 0 to 3000 v AC at 60 cps. Specimen X was electrified at 1500 V AC for 30 seconds and specimen Y electrified at 1000 V AC for 1 minute.

Task B

Investigation of polyurethane resin conformal coatings on XXXP, glass-epoxy and paper-epoxy, copper clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phase 5 Physical and Electrical Properties of polyurethane resin coating systems

Part 3 Dielectric Constant, Dissipation Factor and Q-Factor

(a) Mold

Since the urethane coating systems investigated are of the solvent type, the apparatus discussed in paragraph 4.3.1 of MIL-I-16923C could not be used. We cast films of these coatings, using an apparatus described below and pictured in the Appendix Table XI.

A teflon sheet which had one side etched was bonded to a sheet of lucite to ensure flatness of the teflon. The edges were built up with layers of masking tape so as to confine the liquid urethane into a certain area. In this manner a film having a thickness of 0.015 to 0.020 inches could be obtained.

(b) Two inch disc specimen

The coating material was mixed according to the manufacturers instruction and poured into the mold described above. The resultant coatings were cured for seven days prior to cutting into two inch discs.

(c) Procedure

The procedure for measuring, the dissipation factor, dielectric constant and Q factor is similar to one described in section C, part 3, phase 5 of Task A.

However when measuring the two inch disc specimens at the higher frequencies, the capacity of the specimens was too high to get an accurate measurement.

Part 4 Q-Factor and dissipation factor of the coated test panels

The Q factor and dissipation factor of the coated boards was determined using the same procedure outlined in section d of parts 3 and 4, Phase 5 of Task A in the Factual Data.

Part 5 Temperature Cycling

The polyurethane test specimens were subjected to five cycles of temperature cycling test described in Method 102A, Cond. D of MIL-STD-202.

Part 7 Dielectric Withstanding Voltage, after thermal cycling

Procedure is similar to one outlined in part 7 of phase 5, Task A of the Factual Data.

Part 8 Insulation Resistance, under moisture conditions

The procedure described in part 8, phase 5 of Task A was followed.

Part 9 Dielectric Withstanding Voltage, after moisture resistance

Procedure followed is similar to one outlined in part 4, phase 5 of Task B.

Task C

Investigation of silicone-based polymers on glass-epoxy copper-clad laminate series specified in MIL-P-13949B.

FACTUAL DATA
(Continued)

Phase 1 Silicone-based polymer coatings

Part 1 Characteristics of silicone-based polymer coatings

Two manufacturers of commercially advertised silicone resin coatings for printed circuit boards were contacted and samples of their coatings were received. One coating was of the silicone-phenolic type whereas the other was of the unmodified type. Both coating systems require addition of catalysts to facilitate curing. Both coating systems can be applied by brushing, dipping or spraying. Both coatings were transparent when fully cured and were also fungus resistant.

Part 2 Curing Schedule

The two coating systems were cured at 100°C for 2 hours.

Phase 2 Test Panels Used

The test panels used for evaluating these coatings were

(a) Comb pattern (Specimen Y) fabricated in accordance with Figure 1 and paragraph 4.4.1 of SCL-6225.

(b) Two parallel lines pattern (Specimen X) fabricated in accordance with Figure 1, note 7 of MIL-P-55110.

A diagram of these test patterns appears in the Appendix, Table III at the end of this report.

The test panels were prepared on the following copper-clad laminates, 0.062 inches thick, copper-one side with one and two ounces:

Type GE - Epoxy resin - glass fabric base
Type GB - Epoxy resin - glass fabric base, general purpose, temperature resistant
Type GF - Epoxy resin - glass fabric, flame retardent

For each silicone coating, six test panels consisting of 1 ox. and 2 oz. copper were prepared from the following laminates:

	Spec. X		Spec Y	
Laminate	1 oz. Cu.	2 oz. Cu.	1 oz. Cu.	2 oz. Cu.
Type GE	3	3	3	3
Type GB	3	3	3	3
Type GF	3	3	3	3
Uncoated (control pattern each laminate)	1	1	1	1

FACTUAL DATA
(Continued)

Phase 3 Precoating preparation of Surface

Parts 1 & 2 Cleaning and Soldering

The following cleaning technique is outlined to eliminate as nearly as possible all surface contaminates that would tend to cause corrosion. Panels are prepared for testing using the following cleaning methods:

(a) The etched side of the boards are abraded with a fine grade of steel wool.

(b) The leads are soldered to the terminal points using 60 - 40 rosin core solder.

(c) The soldered boards are scrubbed in isopropyl alcohol to remove the rosin flux and other contaminants.

Phase 4 Method of Coating Application

All test specimens were brush coated.

Phase 5 Physical and Electrical Properties of Silicone Resin Coating Systems

Part 1 Adhesion and Appearance

After the specimen panels were coated, they were visually examined for blistering, wrinkling, cracking and peeling of the coating and corrosion of the conductors.

Part 2 Thickness Measurements

All specimen test panels were coated to a thickness of 0.012 $\pm$ 0.007 inches.

CONCLUSION

Task A and B

Investigation of epoxy resin and polyurethane conformal coatings on XXXP, glass-epoxy and paper-epoxy copper-clad laminate series specified in MIL-P-13949B and PR & C 61-SIMSA-482.

Phase 5 Physical and Electrical Properties of Epoxy and polyurethane resin coating systems

Part 3 Dielectric Constant and Dissipation Factor & Q Factor for epoxy resin coating

The dielectric constant drops as the frequency increases from 1 to 100 mc. On the other hand, the dissipation factor at 1 mc begins at one value and then drops until the frequency reaches 30 mc. and then begins to rise to 100 mc. This observation agrees with Murphy and Morgan (1).

The changes in the dielectric constant and dissipation factor with frequency are produced by the dielectric polarization which exist in the material. The two most important polarizations, caused by various constituents which make up the particular formulation, are (1) dipole polarization due to polar molecules - this effect becomes more noticeable in the higher frequency ranges and (2) interfacial polarization - this effect is seen at the lower frequency spectrum. Each polarization furnishes a maximum of value of dissipation factor. The frequency at which this maximum loss occurs is called the relaxation frequency for that polarization. It is also the frequency at which the dielectric constant is increasing at its greatest rate. From Table VI and VIII as the frequency approaches 1 mc, the dielectric constant and dissipation factor begin to increase in value. This means that below 1 mc, there is a relaxation frequency for epoxy materials.

Part 6 Q-Factor and Dissipation Factor of the Coated Boards

The following conclusions are drawn from a statistical analysis of the data for epoxy coated boards:

(1) An analysis of variance showed that the laminate and the resin were significantly different. These comparisons were made at specific measured frequency. The highest Q values were obtained with the glass-epoxy laminates as compared to the paper-base materials. The following table summarizes the Q values at the test frequencies:

	Frequencies		
Rating	1 mc	50 mc	100 mc
Best	GB	GB	GB, GE & GF
Next	GF	GF & GE	
Worst	GE, XXXP, & EXXXP	EXXXP & XXXP	XXXP, EXXXP

(1) Murphy and Morgan, "The Dielectric Properties of Insulating Materials Bell System Technical Journal Vol 16, October 1937 p.p. 493 - 512.

CONCLUSION
(continued)

(2) The Q values decrease as the frequency increases for the coated and uncoated boards. The change from 1 to 50 mc. and from 50 to 100 mc. is approximately equal indicating an approximate linear relationship within the limits of 1 to 100 mc.

(3) The Q values were lower fob the coated boards than for the uncoated ones. The variability was the same.

(4) The rank of the laminates for the uncoated boards were similar to that of the coated laminates, namely GB, GF and GE followed by XXXP And EXXXP.

(5) From the data, epoxy F is rated the best coating followed by epoxies C and H.

(6) The data indicates that there may be a decrease of Q with an increase in thickness. This relation is apparent in the 1 and 100mc. data but not in the 50mc. data. This relationship may be curvilinear but a full scale test would be necessary to evaluate this.

Part 7 Dielectric Withstanding Voltage, after thermal cycling.

All epoxy and polyurethane specimens passed the dielectric withstanding voltage tests specified in paragraph 4.7.8. of MIL-P-55110 and paragraph 4.4.3.2. of SCL-6225.

Part 8 Insulation Resistance and Appearance under moisture conditions

All epoxy and polyurethane coatings, after fourteen cycles of humidity, passed the minimum resistance values of 1.0 X 10^8 ohms specified in SCL-6225. However, when the test panels were examined for corrosion of conductors, only epoxies C, F and I passed. The other five epoxies exhibited copper conductor corrosion to various degrees.

On the corroded test panels, an interesting observation was noted. The "hot" conductor on both specimen X and Y were corroded whereas the ground conductor showed no evidence of corrosion. This corrosion occured probably between 0 and 1 cycle under humidity. This is evidenced by a drop in the insulation resistance value of the order of magnitude of 10^2 to 10^3 depending on the degree of corrosion present. After this initial insulation resistance drop, the insulation resistance value increases to a maximum and then decreases as the number of humidity cycles increases.

CONCLUSION
(Continued)

We have postulated the following theory, to possibly explain this phenomenon. Between 0 and 1st humidity cycle, the coating absorbs moisture which tends to hydrolyze the constituents in the epoxy formula. A voltage applied to this coating accelerates this hydrolysis reaction which causes a breakdown of the coating in the vicinity of the "hot" conductors. This breakdown causes the 1R drop seen after the 1st cycle. The products of the hydrolysis reaction corrode the copper conductors. As the water absorbed by the coating is used up in the hydrolysis reaction, the 1R value increases to a maximum and then decreases as more water is generally absorbed by the coating.

A coating that does not corrode the copper conductor when a voltage stress is applied will show an increase or no change in the 1R value at the first cycle and then decrease as the number of humidity cycles increases. Typical plots of corroded and uncorroded test panels are shown in the Appendix, p. xxxv.

We feel from these results that we have a quick and economical test to determine the corrosion resistance of a coating under humidity.

Other conclusions drawn from this experiment are as follows:

(1) Do the test results for test patterns X and Y exhibit the same degree of variability?

The following table summarizes the average ranges in logarithms for the two patterns and two types of coatings.

	# of samples	Average range readings	# of samples	Average range readings
Epoxy	190	0.289	200	0.264
Polyurethane	148	0.461	150	0.263

The only odd value was that obtained using pattern Y on the polyurethanes or more variability was obtained using pattern Y on polyurethanes. With the epoxy the two test patterns have equivalent variability. These conclusions are drawn at a significant level of 99.9%. From this analysis, Pattern X should be used more extensively in lieu of Pattern Y.

The test results of test patterns X and Y are correlated. A correlation coefficient of .765 was obtained which shows correlation at a level of reliability of better than 99.9%.

CONCLUSION
(Continued)

(2) What effect does thickness of coating have on the insulation resistance value under humidity?

Only the epoxies were evaluated for this parameter. It was determined that when a 100% solids coating was used such as epoxy A,C,D,E, the insulation resistance increases with increasing thickness. However for solvent-based epoxy coatings such as F,G,H, & I, the insulation resistance decreases with increasing thickness.

A plausible explanation for this effect, is that there is probably solvent trapped in the cured coating which is not easily evaporated in a thicker coating as in a thinner coating. When exposed to humidity, the trapped solvent absorbs water more readily then the coating thereby causing the insulation resistance value to drop.

Part 9 Dielectric Withstanding Voltage, after moisture resistance

All epoxy and polyurethane specimens passed the dielectric withstanding voltage tests specified in paragraph 4.7.8 of MIL-P-55110 and paragraph 4.4.3.2 of SCL-6225.

PROGRAM FOR NEXT INTERVAL

(1) Complete Tasks A through F Phases 1 - 5 where application is feasible.

(2) Begin Phases B and C.

IDENTIFICATION OF KEY PERSONNEL

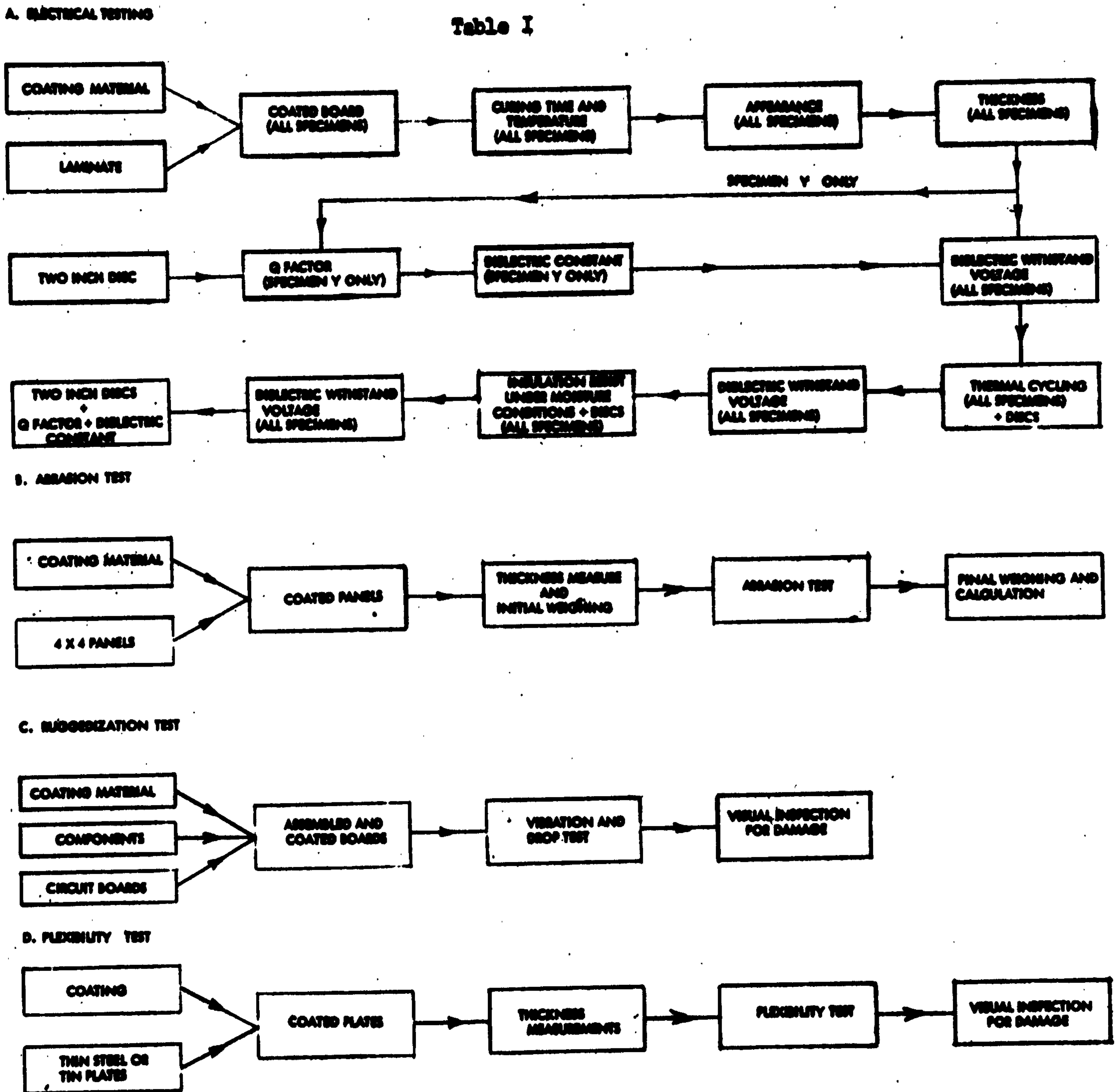
	Time Spent - Hours
Mr. Anthony Beccasio Project Engineer	292
Mr. Ernest Colon Technician	290
Mr. Leonard Nero Statistician	115
Mr. Lester Powell Senior Component Engineer	*
Mr. Arthur Bethke Chemist	*
TOTAL	697

* Mr. Powell and Mr. Bethke are available at no cost to the project.

A P P E N D I X

FLOW CHART FOR PHASE A TESTING

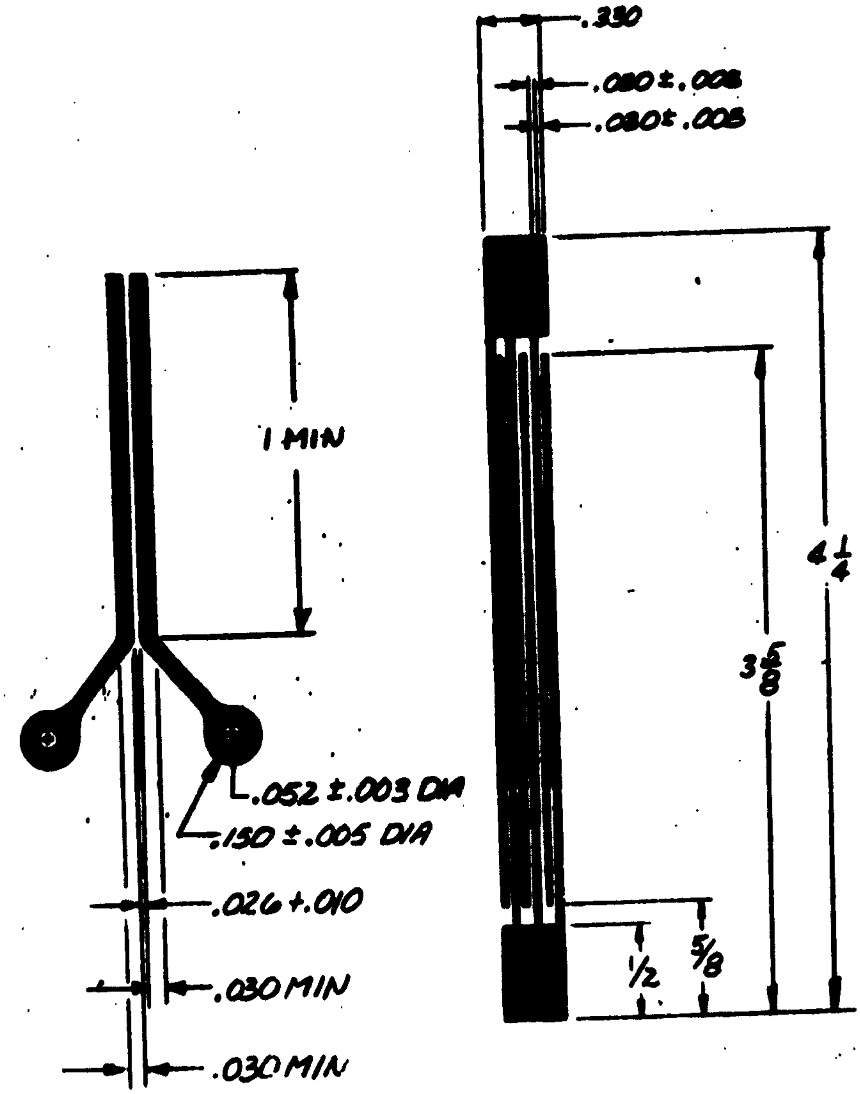
Table I



PREPARED BY A.J.S. AUG. 22, 1961

TABLE II

This table has been purposely omitted.



SPECIMEN X

SPECIMEN Y

TABLE III
TEST PANELS

TABLE IV

THICKNESS MEASUREMENTS OF COATED EPOXY TEST PANELS

Mfr. code no.	Laminate	Test panel	Average thickness (inches)		
			Patt. 1	Patt. 2	Patt. 3
A	XXXP	Y	0.013	0.014	0.008
		X	0.013	0.013	0.010
	GE	Y	0.012	0.014	0.007
		X	0.010	0.008	0.009
	paper epoxy	Y	0.010	0.014	0.019
		X	0.019	0.017	0.012
	GB	Y	0.010	0.010	0.009
		X	0.014	0.011	0.007
	GF	Y	0.019	0.012	0.008
		X	0.019	0.017	0.013
B	paper epoxy	Y	0.009	0.012	0.012
		X	0.007	0.006	0.007
	GB	Y	0.013	0.011	0.012
		X	0.013	0.019	0.018
	GE	Y	0.005	0.004	0.007
		X	0.006	0.006	0.007
	GF	Y	0.005	0.006	0.005
		X	0.006	0.010	0.010
	XXXP	Y	0.006	0.008	0.015
		X	0.004	0.006	0.008
C	GE	Y	0.011	0.012	0.009
		X	0.020	0.018	0.014
	GF	Y	0.004	0.003	0.005
		X	0.012	0.009	0.009
	paper epoxy	Y	0.012	0.016	0.009
		X	0.006	0.008	0.009
	XXXP	Y	0.012	0.008	0.013
		X	0.010	0.012	0.013
	GB	Y	0.019	0.014	0.010
		X	0.015	0.013	0.009
D	GB	Y	0.005	0.009	0.004
		X	0.011	0.011	0.009
	GE	Y	0.011	0.009	0.009
		X	0.010	0.007	0.008
	paper epoxy	Y	0.013	0.019	0.013
		X	0.012	0.010	0.008
	XXXP	Y	0.011	0.011	0.008
		X	0.009	0.013	0.012
	GF	Y	0.016	0.011	0.010
		X	0.015	0.011	0.010
E	GF	Y	0.009	0.016	0.008
		X	0.020	0.022	0.020
	GB	Y	0.016	0.013	0.016
		X	0.016	0.014	0.017
	GE	Y	0.018	0.017	0.012
		X	0.019	0.014	0.015
	XXXP	Y	0.024	0.014	0.013
		X	0.016	0.013	0.014

TABLE 4 (CONT.)

Mfr. code no.	Laminate	Test panel	Average thickness (inches)		
			Patt. 1	Patt. 2	Patt. 3
E	paper epoxy	Y	0.017	0.020	0.019
		X	0.013	0.010	0.017
F	paper epoxy	Y	0.003	0.005	0.005
		X	0.003	0.004	0.005
	GE	Y	0.004	0.003	0.003
		X	0.003	0.005	0.005
	GF	Y	0.004	0.006	0.005
		X	0.002	0.003	0.004
	XXXP	Y	0.004	0.004	0.005
		X	0.004	0.002	0.006
	GB	Y	0.007	0.006	0.003
		X	0.005	0.005	0.006
G	GB	Y	0.007	0.009	0.011
		X	0.008	0.007	0.007
	GE	Y	0.009	0.007	0.008
		X	0.008	0.011	0.008
	XXXP	Y	0.008	0.008	0.010
		X	0.012	0.007	0.008
	GF	Y	0.010	0.006	0.008
		X	0.007	0.009	0.007
	paper epoxy	Y	0.007	0.010	0.011
		X	0.008	0.009	0.009
H	paper epoxy	Y	0.019	0.014	0.005
		X	0.020	0.019	0.019
	XXXP	Y	0.007	0.007	0.005
		X	0.012	0.014	0.017
	GB	Y	0.010	0.009	0.013
		X	0.013	0.009	0.011
	GE	Y	0.011	0.009	0.014
		X	0.014	0.013	0.013
	GF	Y	0.007	0.009	0.007
I	GB	Y	0.006	0.007	0.005
		X	0.007	0.005	0.008
	GE	Y	0.008	0.006	0.007
		X	0.004	0.006	0.008
	GF	Y	0.006	0.007	0.010
		X	0.009	0.005	0.011
	paper epoxy	Y	0.006	0.005	0.007
		X	0.005	0.006	0.007
	XXXP	Y	0.005	0.007	0.007
		X	0.004	0.006	0.010

THICKNESS MEASUREMENTS OF POLYURETHANE COATED PANELS

Mfr. code no.	Laminate	Test panel	Average thickness (inches)		
			Patt. 1	Patt. 2	Patt. 3
AA	GE	Y	0.008	0.009	0.003
		X	0.009	0.010	0.010
	GE	Y	0.010	0.010	0.011
		X	0.010	0.008	0.013
	GF	Y	0.011	0.012	0.015
		X	0.009	0.008	0.008
	paper epoxy	Y	0.010	0.010	0.008
		X	0.012	0.009	0.007
	XXXP	Y	0.010	0.005	0.006
		X	0.008	0.009	0.011
BB	GF	Y	0.010	0.008	0.008
		X	0.005	0.003	0.008
	GB	Y	0.005	0.012	0.011
		X	0.006	0.009	0.008
	XXXP	Y	0.010	0.009	0.008
		X	0.008	0.006	0.007
	GE	Y	0.008	0.008	0.008
		X	0.005	0.008	0.012
	paper epoxy	Y	0.008	0.009	0.012
		X	0.004	0.005	0.008
CC	paper epoxy	X	0.005	0.005	0.005
		Y	0.006	0.006	0.006
	GF	Y	0.004	0.004	0.004
		X	0.006	0.004	0.005
	GE	Y	0.006	0.004	0.005
		X	0.009	0.008	0.006
	GB	Y	0.006	0.007	0.005
		X	0.006	0.006	0.005
	XXXP	Y	0.003	0.004	0.004
		X	0.004	0.005	0.006
DD	GB	Y	0.009	0.007	0.009
		X	0.006	0.008	0.006
	GF	Y	0.004	0.005	0.012
		X	0.008	0.009	0.007
	GE	Y	0.008	0.007	0.008
		X	0.009	0.009	0.010
	paper epoxy	Y	0.003	0.014	0.015
		X	0.005	0.005	0.009
	XXXP	Y	0.005	0.008	0.009
		X	0.007	0.004	0.006
GG	paper epoxy	Y	0.020	0.006	0.008
		X	0.005	0.011	0.008
	GE	Y	0.007	0.008	0.006
		X	0.007	0.007	0.017
	XXXP	Y	0.005	0.007	0.005
		X	0.010	0.006	0.006
	GF	Y	0.008	0.010	0.007
		X	0.015	0.011	0.006

Mfr. code no.	Laminate	Test panel	Average thickness (inches)		
			Patt. 1	Patt. 2	Patt. 3
GG	GB	Y	0.010	0.011	0.006
		X	0.013	0.006	0.006
HH	paper epoxy	Y	0.007	0.008	0.005
		X	0.005	0.006	0.014
	GF	Y	0.014	0.005	0.006
		X	0.005	0.012	0.010
	XXXP	Y	0.006	0.007	0.006
		X	0.007	0.006	0.009
	GB	Y	0.006	0.008	0.011
		X	0.011	0.009	0.008
	GE	Y	0.004	0.007	0.007
		X	0.010	0.009	0.009
II	GE	Y	0.010	0.007	0.005
		X	0.009	0.007	0.008
	paper epoxy	Y	0.004	0.007	0.010
		X	0.007	0.009	0.009
	GF	Y	0.007	0.009	0.010
		X	0.010	0.007	0.006
	XXXP	Y	0.007	0.005	0.005
		X	0.007	0.006	0.009
	GB	Y	0.005	0.005	0.011
		X	0.007	0.008	0.006

TABLE V

DIELECTRIC CONSTANT OF

EPOXY COATING TWO INCH DISCS

MFR. Code #	Dielectric Constant at 1 mc	3 mc	6.25 mc	30	50	75	100
A	3.63	3.51	3.36	3.28	3.26	3.23	3.17
B	3.34	3.20	3.14	3.07	3.04	3.01	3.00
C	4.28	4.04	3.81	3.65	3.65	3.57	3.46
D	3.15	3.06	2.99	2.90	2.87	2.83	2.81
G	4.46	4.22	4.03	3.96	3.59	3.54	3.48
H	3.40	3.36	3.32	3.24	3.17	3.14	3.13
I	4.18	4.04	3.86	3.68	3.54	3.48	3.36

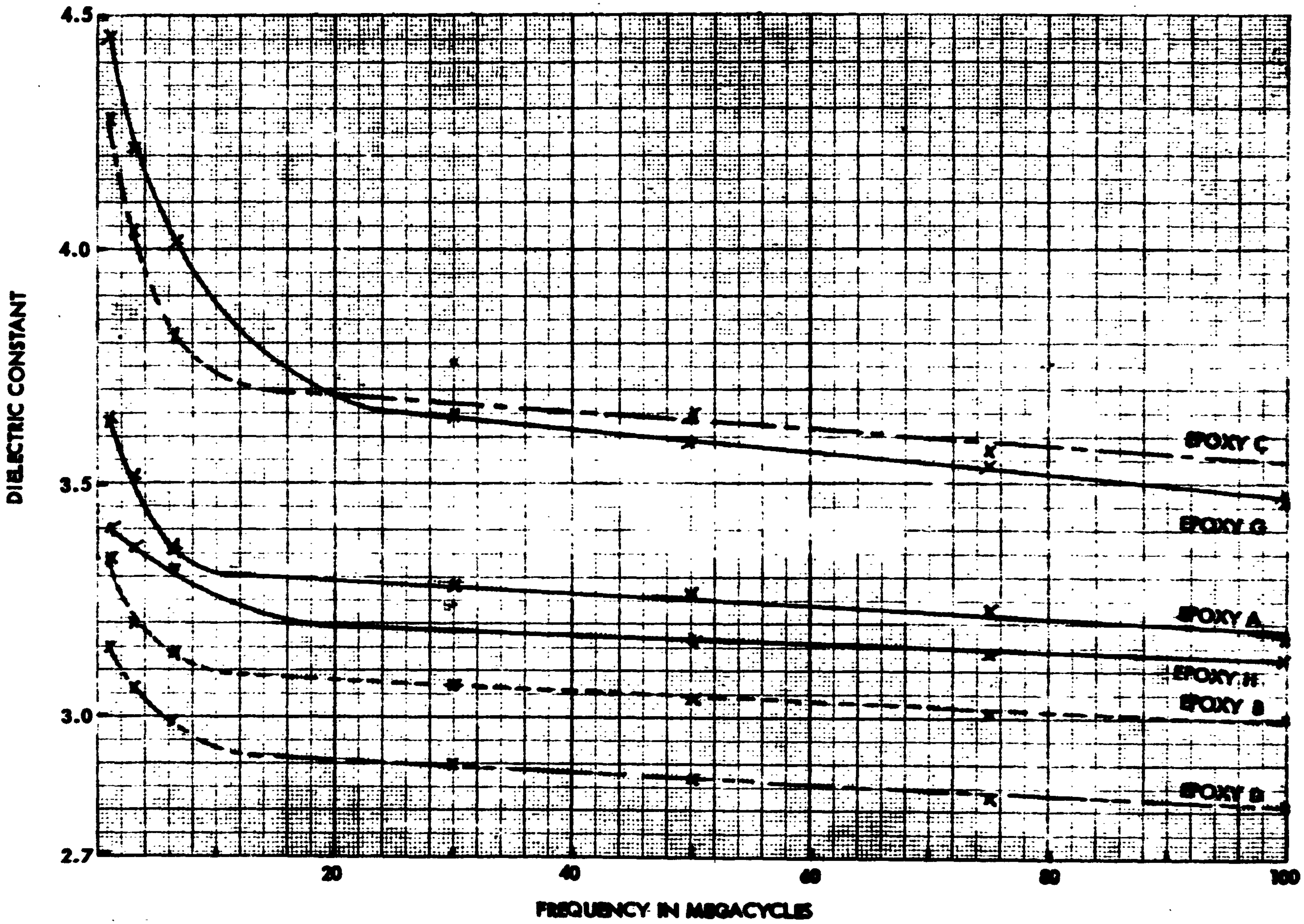


FIGURE VI
DIELECTRIC CONSTANT VS. FREQUENCY

TABLE VII

DISSIPATION FACTOR OF

EPOXY COATINGS TWO INCH

DISC SPECIMENS

MFR. Code #	DISSIPATION FACTOR AT 1 mc	3 mc	6.25 mc	30 mc	50 mc	75 mc	100 mc
A	0.054	0.049	0.044	0.040	0.042	0.047	0.049
B	0.047	0.030	0.035	0.030	0.030	0.033	0.034
C	0.076	0.075	0.077	0.065	0.078	0.070	0.080
D	0.056	0.047	0.052	0.034	0.030	0.031	0.034
G	0.064	0.059	0.073	0.045	0.052	0.066	0.040
H	0.016	0.018	0.023	0.020	0.019	0.026	0.020
I	0.039	0.040	0.058	0.036	0.044	0.059	——

DISSIPATION FACTOR VS. FREQUENCY

TABLE VIII

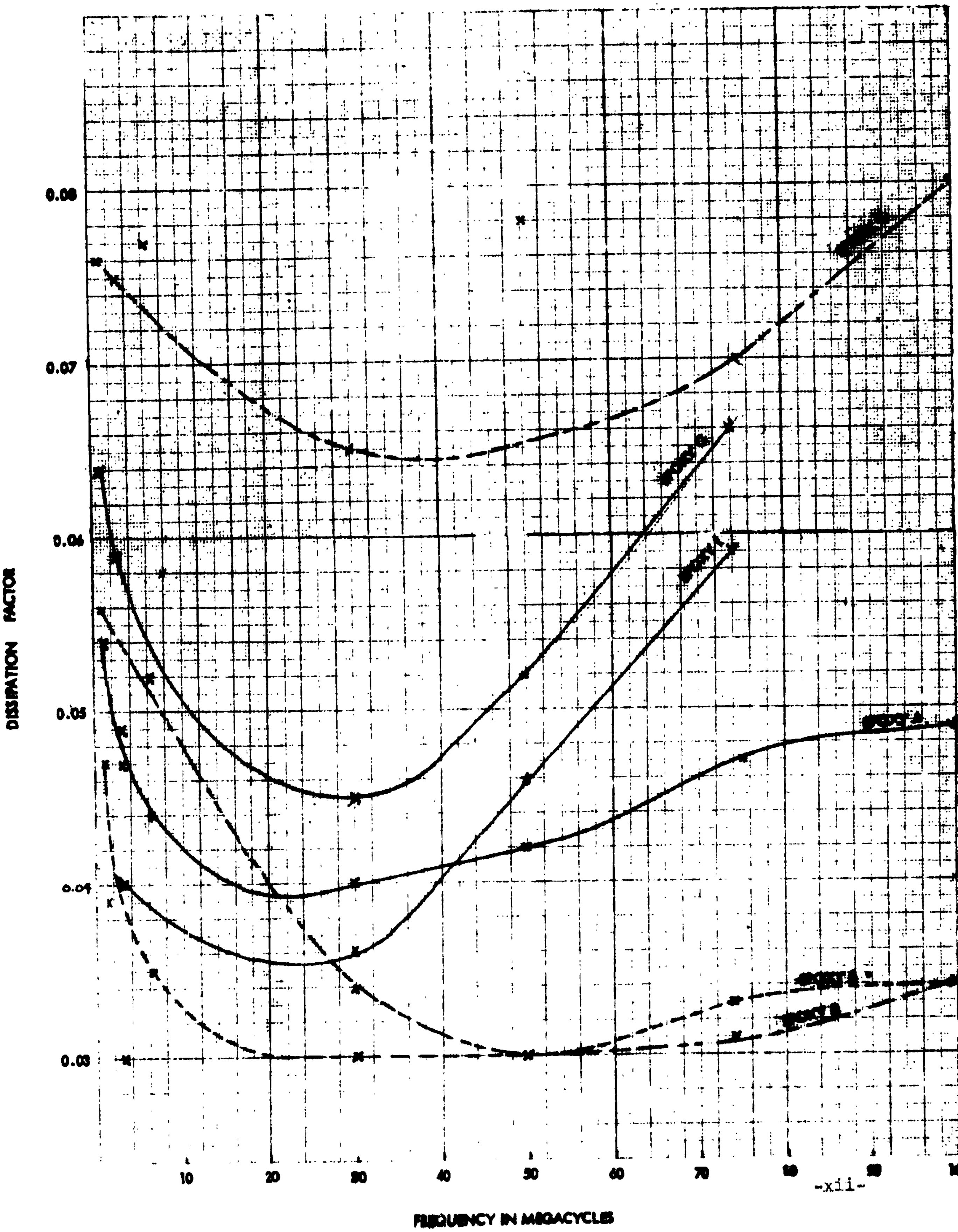


TABLE IX (CONT.)

Mfr. code no.	Laminate	Test specimen type	Average thick. of panels	1 mc.		50 mc.		100 mc.	
				Av. Q	Av. DF	Av. Q	Av. DF	Av. Q	Av. DF
F	GE	control	-	97.0	0.010	99.3	0.010	83.3	0.012
		coated	0.003	70.4	0.014	108.5	0.009	97.3	0.010
	GB	control	-	171.6	0.006	131.1	0.008	100.3	0.010
		coated	0.005	131.6	0.008	106.8	0.010	122.3	0.008
	GF	control	-	123.8	0.008	91.7	0.011	82.7	0.012
		coated	0.005	109.1	0.009	90.8	0.011	132.4	0.008
	EXXXP (PE)	control	-	66.4	0.015	51.4	0.020	38.7	0.026
		coated	0.004	65.0	0.015	49.2	0.020	46.0	0.022
	PP	control	-	68.2	0.015	43.5	0.021	37.9	0.026
		coated	0.005	63.9	0.016	47.5	0.021	70.6	0.014
G	GE	control	-	93.9	0.011	71.3	0.014	80.7	0.012
		coated	0.009	57.0	0.018	53.9	0.019	47.5	0.021
	GB	control	-	164.8	0.006	114.4	0.009	80.4	0.012
		coated	0.007	84.7	0.012	73.4	0.014	62.4	0.016
	GF	control	-	156.2	0.006	60.9	0.015	65.3	0.015
		coated	0.008	61.0	0.016	57.8	0.017	51.3	0.020
	EXXXP (PE)	control	-	66.9	0.015	35.3	0.023	38.2	0.026
		coated	0.008	47.2	0.021	33.0	0.026	32.3	0.030
	PP	control	-	70.2	0.014	62.4	0.016	36.6	0.027
		coated	0.009	50.4	0.020	33.5	0.027	33.0	0.030
H	GE	control	-	127.5	0.008	94.9	0.011	76.3	0.014
		coated	0.013	95.8	0.010	71.4	0.014	68.9	0.015
	GB	control	-	156.7	0.006	118.8	0.008	76.8	0.013
		coated	0.011	124.6	0.008	71.5	0.014	79.3	0.013
	GF	control	-	124.6	0.008	95.5	0.010	75.2	0.013
		coated	0.015	102.8	0.010	74.2	0.014	78.3	0.013
	EXXXP (PE)	control	-	59.1	0.017	68.2	0.015	31.9	0.031
		coated	0.020	58.1	0.017	40.9	0.024	35.8	0.028
	PP	control	-	80.4	0.012	47.5	0.021	43.2	0.023
		coated	0.014	65.6	0.015	39.4	0.025	43.2	0.023
I	GE	control	-	100.0	0.010	93.3	0.011	81.8	0.012
		coated	0.006	75.0	0.013	68.9	0.015	59.7	0.017
	GB	control	-	136.1	0.007	103.9	0.010	86.1	0.012
		coated	0.006	124.8	0.008	79.3	0.013	69.2	0.014
	GF	control	-	127.6	0.008	95.2	0.011	77.9	0.013
		coated	0.008	99.1	0.010	78.8	0.013	64.7	0.015
	EXXXP (PE)	control	-	60.3	0.017	43.0	0.023	39.7	0.025
		coated	0.006	54.1	0.018	35.8	0.028	35.4	0.031
	PP	control	-	72.6	0.014	46.0	0.022	45.3	0.022
		coated	0.007	64.6	0.015	43.2	0.023	37.3	0.027

TABLE X

Q-FACTOR AND DISSIPATION FACTOR MEASUREMENTS OF POLYURETHANE COATED SPECIMEN X TEST PANELS

Mfr. code no.	Laminate	Test specimen type	Average thick. of panels	1 mc.		50 mc.		100 mc.	
				Av. Q	Av. DF	Av. Q	Av. DF	Av. Q	Av. DF
AA	GE	control	-	72.1	0.014	102.9	0.010	72.8	0.014
		coated	0.010	65.4	0.015	76.2	0.013	57.9	0.017
	GB	control	-	91.2	0.011	124.8	0.008	89.9	0.011
		coated	0.010	79.7	0.013	94.1	0.011	69.7	0.014
	GF	control	-	92.8	0.011	106.0	0.009	85.4	0.012
		coated	0.008	79.1	0.013	84.3	0.012	62.7	0.016
	EXXXP (PE)	control	-	46.2	0.022	44.4	0.022	43.4	0.023
		coated	0.009	39.9	0.025	42.1	0.024	36.3	0.028
	PP	control	-	54.7	0.018	53.0	0.019	43.4	0.023
		coated	0.009	46.3	0.022	48.0	0.021	35.1	0.029
BB	GE	control	-	64.8	0.015	76.0	0.013	62.9	0.016
		coated	0.008	49.5	0.020	64.1	0.016	51.7	0.019
	GB	control	-	108.7	0.009	130.7	0.008	82.2	0.012
		coated	0.011	68.2	0.015	89.2	0.011	67.3	0.015
	GF	control	-	88.9	0.011	97.5	0.010	85.4	0.012
		coated	0.005	65.3	0.015	87.4	0.011	65.2	0.017
	EXXXP (PE)	control	-	41.4	0.027	46.0	0.022	36.2	0.028
		coated	0.006	37.1	0.027	40.8	0.025	37.1	0.027
	PP	control	-	51.6	0.020	47.3	0.021	39.7	0.025
		coated	0.010	41.4	0.024	60.2	0.017	35.1	0.029
CC	GE	control	-	69.9	0.014	91.0	0.011	70.1	0.014
		coated	0.009	82.6	0.012	82.6	0.012	64.2	0.016
	GB	control	-	81.3	0.012	105.3	0.010	82.2	0.012
		coated	0.007	75.8	0.013	94.1	0.011	66.7	0.015
	GF	control	-	99.8	0.010	107.3	0.009	85.4	0.012
		coated	0.008	80.4	0.012	88.2	0.011	63.0	0.016
	EXXXP (PE)	control	-	47.2	0.021	43.1	0.023	39.7	0.025
		coated	0.006	42.7	0.024	42.4	0.024	36.8	0.027
	PP	control	-	54.0	0.018	51.7	0.019	43.4	0.023
		coated	0.006	47.8	0.021	50.0	0.020	39.9	0.025
DD	GE	control	-	60.9	0.017	77.9	0.013	65.4	0.015
		coated	0.009	62.3	0.016	74.5	0.013	56.6	0.018
	GB	control	-	74.0	0.014	127.5	0.008	84.1	0.012
		coated	0.007	100.6	0.010	109.9	0.009	73.9	0.014
	GF	control	-	102.8	0.010	96.7	0.010	75.6	0.013
		coated	0.008	81.1	0.012	92.0	0.011	67.5	0.015
	EXXXP (PE)	control	-	44.0	0.023	43.1	0.023	38.0	0.026
		coated	0.006	42.7	0.023	42.3	0.023	38.7	0.026
	PP	control	-	51.3	0.020	44.6	0.022	38.0	0.026
		coated	0.006	49.7	0.020	47.4	0.021	37.2	0.027

TABLE X (CONT.)

Mfr. code no.	Laminate	Test specimen type	Average thick. of panels	1 mc.		50 mc.		100 mc.	
				Av. Q	Av. DF	Av. Q	Av. DF	Av. Q	Av. DF
GG	GE	control	-	60.9	0.016	76.0	0.013	65.4	0.015
		coated	0.010	57.4	0.017	69.3	0.014	49.2	0.020
	GB	control	-	119.8	0.008	110.4	0.009	91.9	0.011
		coated	0.008	101.6	0.010	97.8	0.010	77.8	0.013
	GF	control	-	88.7	0.011	95.9	0.010	74.9	0.013
		coated	0.011	81.4	0.012	82.1	0.012	64.3	0.015
	EXXXP (PE)	control	-	44.0	0.023	44.5	0.023	39.6	0.025
		coated	0.008	39.2	0.025	42.1	0.024	51.6	0.019
	PP	control	-	55.8	0.018	51.0	0.020	41.3	0.024
		coated	0.007	45.3	0.022	45.4	0.022	36.3	0.028
HH	GE	control	-	66.6	0.015	75.5	0.013	59.3	0.017
		coated	0.009	55.1	0.018	66.5	0.015	51.6	0.019
	GB	control	-	107.1	0.009	124.8	0.008	79.0	0.013
		coated	0.009	82.7	0.012	98.2	0.010	74.4	0.013
	GF	control	-	88.5	0.011	104.0	0.010	72.6	0.014
		coated	0.009	67.4	0.015	83.5	0.012	62.9	0.016
	EXXXP (PE)	control	-	44.0	0.023	43.4	0.023	39.7	0.025
		coated	0.008	37.9	0.026	41.8	0.024	34.1	0.029
	PP	control	-	49.7	0.020	45.3	0.023	38.0	0.026
		coated	0.007	45.5	0.022	43.0	0.023	36.2	0.028
II	GE	control	-	76.1	0.013	99.6	0.010	72.7	0.014
		coated	0.008	61.4	0.016	72.7	0.014	55.0	0.018
	GB	control	-	81.3	0.012	100.5	0.010	69.8	0.014
		coated	0.007	68.2	0.015	80.6	0.012	63.3	0.016
	GF	control	-	86.2	0.012	107.1	0.009	82.1	0.012
		coated	0.008	70.3	0.014	77.6	0.013	61.7	0.016
	EXXXP (PE)	control	-	45.7	0.022	46.7	0.021	78.9	0.013
		coated	0.008	38.3	0.026	40.5	0.025	38.3	0.026
	PP	control	-	52.6	0.019	55.2	0.018	39.6	0.025
		coated	0.007	44.6	0.022	46.7	0.021	33.7	0.030

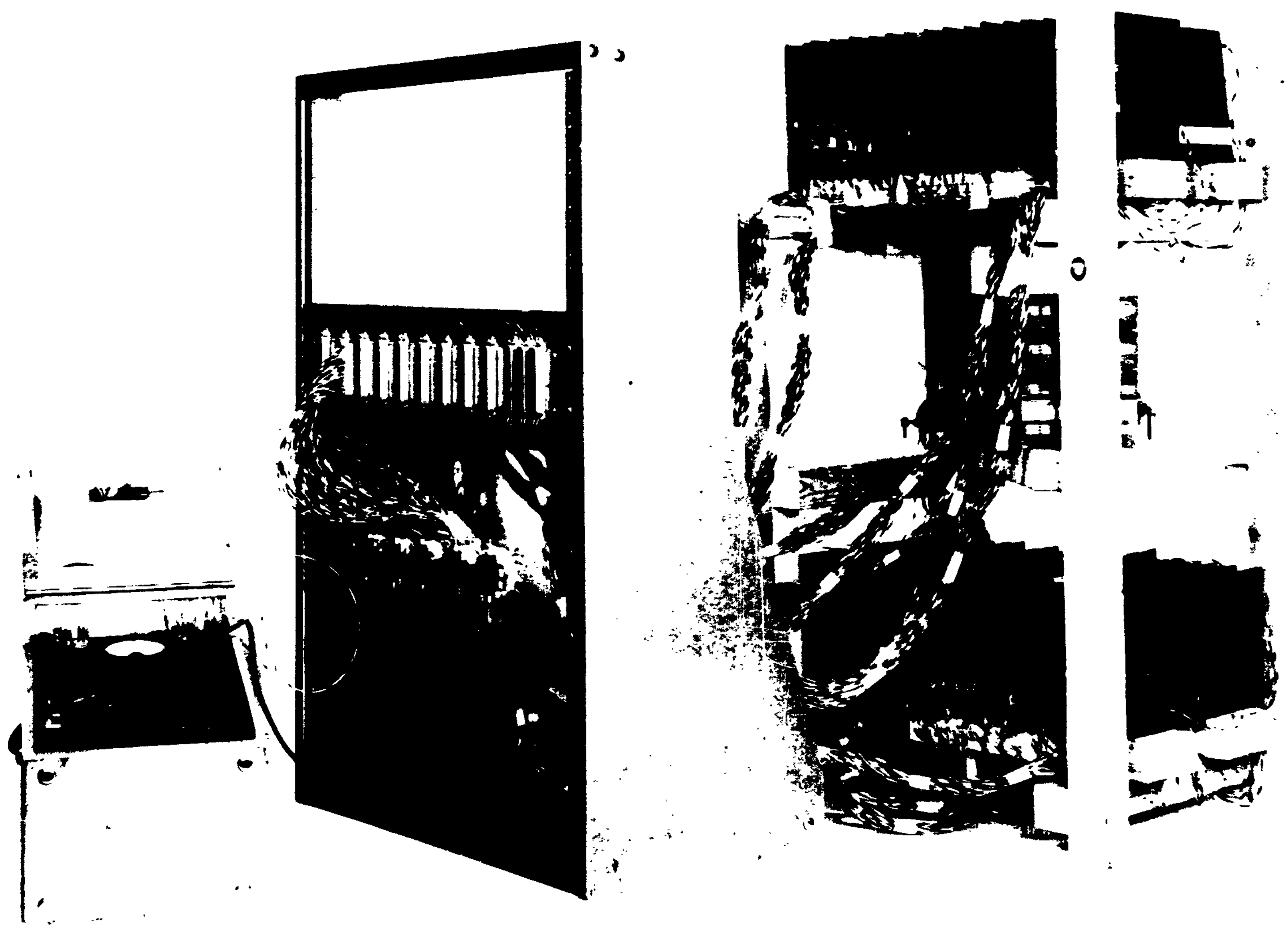


TABLE XI - PHOTOGRAPH OF INSULATION RESISTANCE TEST SETUP

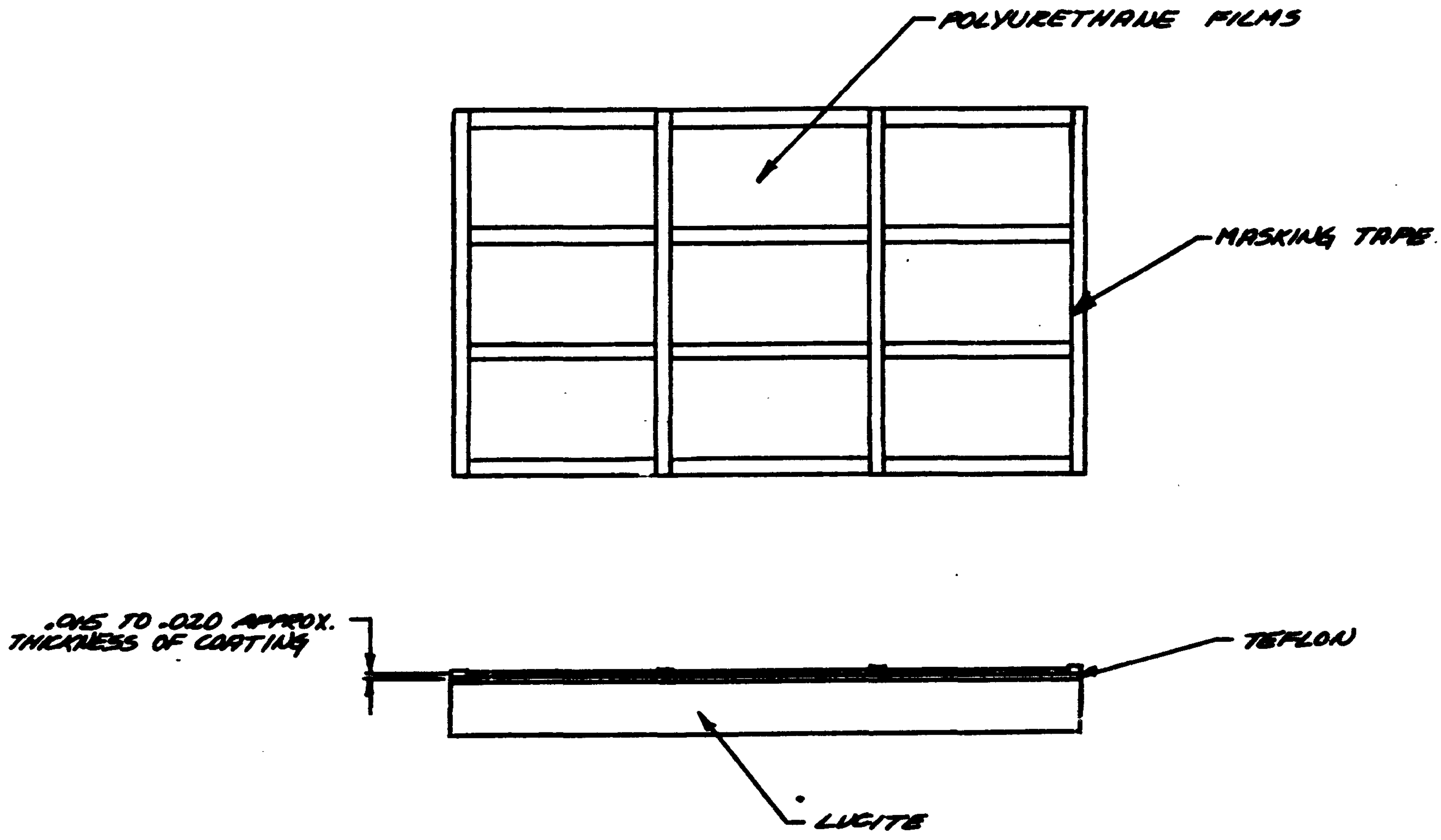


FIGURE XII
POLYURETHANE CASTING MOLD

DRAWN BY: E.H. COLON
26 OCT 61

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11 Sample A	1	8.5×10^{11}	1.5×10^{10}	6.5×10^{10}	4.5×10^{10}	8.0×10^{10}	6.0×10^{10}
	2	8.0×10^{11}	1.5×10^{10}	7.0×10^{10}	4.2×10^{10}	7.5×10^{10}	5.0×10^{10}
	3	7.5×10^{11}	2.0×10^{10}	8.0×10^{10}	7.0×10^{10}	1.0×10^{11}	6.0×10^{10}
	Control	1.5×10^{12}	4.0×10^{7}	6.0×10^{11}	1.0×10^{11}	3.0×10^{10}	1.5×10^{10}
G-10 Sample A	1	5.0×10^{11}	8.0×10^{9}	5.0×10^{10}	3.5×10^{10}	8.0×10^{10}	6.0×10^{10}
	2	5.0×10^{11}	7.0×10^{9}	5.5×10^{10}	3.0×10^{10}	8.0×10^{10}	6.0×10^{10}
	3	5.0×10^{11}	1.5×10^{10}	9.0×10^{10}	7.0×10^{10}	1.1×10^{11}	8.0×10^{10}
	Control	1.0×10^{12}	2.2×10^{6}	8.0×10^{9}	1.5×10^{8}	1.5×10^{8}	1.5×10^{7}
EXXXP Sample A	1	6.0×10^{11}	1.2×10^{10}	3.0×10^{10}	2.0×10^{10}	2.2×10^{10}	1.0×10^{10}
	2	5.0×10^{11}	9.0×10^{9}	2.5×10^{10}	1.8×10^{10}	2.5×10^{10}	1.1×10^{10}
	3	4.0×10^{11}	8.0×10^{9}	2.5×10^{10}	1.7×10^{10}	2.5×10^{10}	1.3×10^{10}
	Control	7.0×10^{11}	6.0×10^{8}	5.0×10^{10}	1.5×10^{10}	1.5×10^{10}	7.0×10^{9}
GF Sample A	1	5.0×10^{11}	6.0×10^{9}	2.5×10^{10}	8.0×10^{9}	1.0×10^{10}	8.0×10^{9}
	2	5.0×10^{11}	7.0×10^{9}	2.5×10^{10}	1.0×10^{10}	1.5×10^{10}	8.0×10^{9}
	3	5.0×10^{11}	9.0×10^{9}	4.0×10^{10}	1.5×10^{10}	1.5×10^{10}	1.0×10^{10}
	Control	9.0×10^{11}	3.5×10^{7}	1.0×10^{9}	7.0×10^{9}	4.0×10^{9}	1.0×10^{8}
XXXP Sample A	1	2.5×10^{11}	4.0×10^{9}	2.0×10^{10}	1.5×10^{10}	3.0×10^{10}	2.5×10^{10}
	2	2.5×10^{11}	6.0×10^{9}	2.5×10^{10}	1.5×10^{10}	4.0×10^{10}	2.5×10^{10}
	3	5.0×10^{11}	1.5×10^{10}	6.0×10^{10}	4.0×10^{10}	7.0×10^{10}	4.0×10^{10}
	Control	1.1×10^{12}	7.0×10^{7}	2.0×10^{11}	1.5×10^{11}	1.5×10^{11}	1.0×10^{11}
EXXP Sample C	1	$1\ \times10^{12}$	2.0×10^{12}	4.0×10^{11}	2.5×10^{11}	2.5×10^{11}	2.0×10^{11}
	2	1.2×10^{12}	1.5×10^{12}	4.0×10^{11}	2.0×10^{11}	2.0×10^{11}	1.5×10^{11}
	3	1.5×10^{12}	1.5×10^{12}	3.5×10^{11}	2.5×10^{11}	2.5×10^{11}	2.0×10^{11}
	Control	1.5×10^{12}	2.0×10^{10}	5.0×10^{11}	3.0×10^{11}	3.5×10^{11}	2.5×10^{11}
GF Sample C	1	2.0×10^{12}	1.0×10^{12}	3.0×10^{11}	1.5×10^{11}	1.5×10^{11}	9.0×10^{10}
	2	2.0×10^{12}	9.0×10^{11}	3.0×10^{11}	1.2×10^{11}	1.2×10^{11}	8.0×10^{10}
	3	2.5×10^{12}	1.0×10^{12}	3.0×10^{11}	1.3×10^{11}	1.3×10^{11}	7.0×10^{10}
	Control	2.5×10^{12}	2.2×10^{7}	3.0×10^{7}	Erratic	1.2×10^{5}	2.0×10^{4}
G-10 Sample C	1	3.0×10^{12}	9.0×10^{11}	7.0×10^{11}	3.5×10^{11}	3.0×10^{11}	2.0×10^{11}
	2	3.0×10^{12}	1.3×10^{12}	7.0×10^{11}	3.5×10^{11}	3.0×10^{11}	2.5×10^{11}
	3	1.5×10^{12}	1.8×10^{12}	5.0×10^{11}	2.5×10^{11}	2.5×10^{11}	1.5×10^{11}
	Control	2.0×10^{12}	2.6×10^{7}	4.5×10^{7}	6.5×10^{7}	3.0×10^{6}	1.0×10^{7}
XXXP Sample C	1	2.0×10^{12}	5.0×10^{11}	2.5×10^{11}	1.0×10^{11}	5.0×10^{10}	1.1×10^{10}
	2	3.0×10^{12}	6.0×10^{11}	3.0×10^{11}	8.0×10^{10}	4.5×10^{10}	1.0×10^{10}
	3	3.0×10^{12}	4.0×10^{11}	3.0×10^{11}	7.0×10^{10}	3.0×10^{10}	1.0×10^{10}
	Control	3.0×10^{12}	1.3×10^{6}	5.5×10^{7}	2.0×10^{8}	1.5×10^{6}	1.0×10^{6}
G-11 Sample C	1	5.5×10^{12}	1.0×10^{12}	5.0×10^{11}	2.0×10^{11}	1.5×10^{11}	1.1×10^{11}
	2	5.5×10^{12}	1.5×10^{12}	5.0×10^{11}	2.0×10^{11}	1.8×10^{11}	1.0×10^{11}
	3	5.0×10^{12}	1.3×10^{12}	6.0×10^{11}	3.0×10^{11}	2.0×10^{11}	1.0×10^{11}
	Control	5.6×10^{12}	4.6×10^{7}	2.5×10^{8}	2.5×10^{8}	6.0×10^{7}	1.0×10^{8}

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11	1	1.5×10^{12}	2.0×10^{9}	2.0×10^{10}	1.0×10^{10}	1.0×10^{10}	8.0×10^{9}
	2	6.0×10^{11}	9.0×10^{8}	5.0×10^{9}	2.1×10^{9}	4.0×10^{9}	3.0×10^{9}
Sample D	3	8.0×10^{11}	5.0×10^{9}	2.5×10^{10}	1.5×10^{10}	1.5×10^{10}	1.3×10^{10}
	Control	1.2×10^{12}	2.0×10^{8}	9.0×10^{9}	1.5×10^{9}	1.0×10^{7}	1.5×10^{7}
XXXP	1	4.0×10^{11}	9.0×10^{8}	4.0×10^{9}	1.6×10^{9}	2.5×10^{9}	2.5×10^{9}
	2	4.5×10^{11}	1.5×10^{9}	5.5×10^{9}	2.5×10^{9}	4.0×10^{9}	3.0×10^{9}
Sample D	3	5.0×10^{11}	3.0×10^{9}	1.5×10^{10}	7.0×10^{9}	9.0×10^{9}	7.0×10^{9}
	Control	1.0×10^{12}	1.0×10^{10}	2.0×10^{11}	1.3×10^{11}	7.0×10^{10}	1.0×10^{11}
GF	1	3.5×10^{11}	8.0×10^{8}	2.5×10^{9}	1.5×10^{9}	1.5×10^{9}	1.3×10^{11}
	2	4.0×10^{11}	9.0×10^{8}	3.5×10^{9}	2.0×10^{9}	1.8×10^{9}	1.5×10^{11}
Sample D	3	4.0×10^{11}	1.0×10^{9}	2.0×10^{10}	2.2×10^{9}	2.5×10^{9}	2.0×10^{9}
	Control	1.0×10^{12}	5.0×10^{7}	3.0×10^{7}	3.0×10^{8}	3.0×10^{4}	3.0×10^{4}
EXXXP	1	4.0×10^{11}	6.0×10^{8}	3.0×10^{9}	2.0×10^{9}	2.0×10^{9}	1.8×10^{9}
	2	2.5×10^{11}	7.0×10^{8}	2.5×10^{9}	1.3×10^{9}	1.5×10^{9}	1.1×10^{9}
Sample D	3	3.5×10^{11}	6.5×10^{8}	3.0×10^{9}	1.6×10^{9}	2.0×10^{9}	1.5×10^{9}
	Control	1.1×10^{12}	1.0×10^{9}	2.0×10^{10}	1.5×10^{10}	9.0×10^{9}	3.5×10^{9}
G-10	1	5.0×10^{11}	9.0×10^{8}	5.0×10^{9}	3.0×10^{9}	4.0×10^{9}	3.5×10^{9}
	2	4.0×10^{11}	9.0×10^{8}	5.5×10^{9}	3.5×10^{9}	4.5×10^{9}	3.5×10^{9}
Sample D	3	5.0×10^{11}	1.2×10^{9}	8.0×10^{9}	5.5×10^{9}	7.0×10^{9}	6.0×10^{9}
	Control	1.1×10^{12}	2.8×10^{7}	3.0×10^{7}	1.0×10^{7}	1.5×10^{7}	3.0×10^{6}
G-10	1	8.0×10^{11}	1.5×10^{9}	2.0×10^{9}	1.5×10^{9}	1.8×10^{9}	1.9×10^{9}
	2	1.0×10^{12}	1.6×10^{9}	3.0×10^{9}	2.0×10^{9}	2.0×10^{9}	2.0×10^{9}
Sample E	3	1.0×10^{12}	1.8×10^{9}	3.5×10^{9}	1.9×10^{9}	2.0×10^{9}	2.0×10^{9}
	Control	1.5×10^{12}	4.0×10^{7}	3.0×10^{7}	Erratic	5.0×10^{4}	3.0×10^{4}
G-11	1	1.0×10^{12}	1.2×10^{9}	2.5×10^{9}	2.0×10^{9}	1.8×10^{9}	2.0×10^{9}
	2	1.5×10^{12}	1.5×10^{9}	3.5×10^{9}	2.8×10^{9}	2.5×10^{9}	2.5×10^{9}
Sample E	3	7.0×10^{11}	1.5×10^{9}	2.5×10^{9}	2.2×10^{9}	2.8×10^{9}	2.0×10^{9}
	Control	1.5×10^{12}	1.0×10^{7}	2.0×10^{7}	3.0×10^{8} Erratic	1.5×10^{8}	2.0×10^{8}
GF	1	2.0×10^{12}	1.2×10^{12}	5.0×10^{10}	1.5×10^{10}	1.0×10^{10}	7.0×10^{9}
	2	2.0×10^{12}	1.5×10^{12}	6.0×10^{10}	1.5×10^{10}	1.1×10^{10}	7.0×10^{9}
Sample F	3	2.5×10^{12}	1.9×10^{12}	6.0×10^{10}	2.0×10^{10}	1.3×10^{10}	7.0×10^{9}
	Control	2.5×10^{12}	3.5×10^{8}	3.0×10^{7}	1.0×10^{8} Erratic	2.5×10^{7}	2.5×10^{7}
G-10	1	3.0×10^{12}	1.5×10^{12}	7.0×10^{11}	4.0×10^{11}	1.5×10^{12}	5.0×10^{11}
	2	3.0×10^{12}	1.1×10^{12}	8.0×10^{11}	4.0×10^{11}	9.0×10^{11}	5.0×10^{11}
Sample F	3	3.0×10^{12}	1.1×10^{12}	8.0×10^{11}	4.0×10^{11}	9.0×10^{11}	5.0×10^{11}
	Control	3.5×10^{12}	4.5×10^{7}	4.0×10^{7}	9.0×10^{7}	1.8×10^{7}	7.0×10^{6}
EXXXP	1	1.5×10^{12}	2.5×10^{11}	4.0×10^{10}	3.5×10^{10}	2.5×10^{10}	1.0×10^{10}
	2	1.9×10^{12}	6.0×10^{11}	1.0×10^{11}	8.0×10^{10}	5.0×10^{10}	1.8×10^{10}
Sample F	3	2.0×10^{12}	7.0×10^{10}	6.0×10^{10}	5.5×10^{10}	3.0×10^{10}	1.1×10^{10}
	Control	2.5×10^{12}	1.5×10^{8}	8.0×10^{9}	1.1×10^{10}	7.0×10^{9}	3.0×10^{9}
XXXP	1	5.0×10^{12}	1.2×10^{12}	1.5×10^{11}	1.2×10^{11}	1.2×10^{11}	9.0×10^{10}
	2	3.5×10^{12}	1.0×10^{12}	1.5×10^{11}	1.5×10^{11}	1.5×10^{11}	1.0×10^{11}
Sample F	3	3.5×10^{12}	9.0×10^{11}	2.0×10^{11}	1.5×10^{11}	1.5×10^{11}	1.0×10^{11}
	Control	4.0×10^{12}	5.5×10^{7}	5.0×10^{7}	3.0×10^{8} Erratic	8.0×10^{6}	1.0×10^{7}

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11	1	4.0×10^{12}	1.5×10^{12}	6.0×10^{11}	2.5×10^{11}	4.0×10^{11}	1.5×10^{11}
	2	3.5×10^{12}	1.1×10^{12}	5.0×10^{11}	3.0×10^{11}	4.0×10^{11}	1.5×10^{11}
Sample F	3	2.0×10^{12}	8.0×10^{11}	4.0×10^{11}	2.5×10^{11}	3.0×10^{11}	1.5×10^{11}
	Control	3.0×10^{12}	3.5×10^{7}	5.0×10^{7}	Erratic & Leaky	5.0×10^{3}	7.0×10^{3}
G-11	1	3.0×10^{12}	1.5×10^{9}	6.0×10^{9}	1.5×10^{10}	2.0×10^{10}	1.5×10^{9}
	2	2.5×10^{12}	1.5×10^{9}	8.0×10^{9}	1.5×10^{10}	1.5×10^{10}	1.0×10^{9}
Sample G	3	1.5×10^{12}	1.6×10^{9}	3.5×10^{9}	7.0×10^{9}	1.5×10^{9}	1.5×10^{9}
	Control	3.0×10^{12}	3.2×10^{7}	1.5×10^{7}	7.0×10^{6}	5.0×10^{6}	2.6×10^{4}
EXXXP	1	2.5×10^{12}	4.5×10^{9}	8.0×10^{9}	1.5×10^{10}	1.8×10^{10}	2.0×10^{9}
	2	1.5×10^{12}	2.0×10^{9}	5.0×10^{9}	1.0×10^{10}	1.0×10^{10}	2.0×10^{9}
Sample G	3	1.2×10^{12}	1.8×10^{9}	3.0×10^{9}	6.0×10^{9}	6.0×10^{9}	1.2×10^{9}
	Control	2.5×10^{12}	9.0×10^{7}	7.0×10^{5}	4.0×10^{10}	1.5×10^{11}	3.0×10^{10}
GF	1	1.2×10^{12}	2.0×10^{9}	4.0×10^{9}	7.0×10^{9}	9.0×10^{9}	9.0×10^{8}
	2	1.5×10^{12}	4.0×10^{9}	5.0×10^{9}	1.0×10^{10}	1.6×10^{10}	6.0×10^{8}
Sample G	3	1.2×10^{12}	3.0×10^{9}	4.0×10^{9}	9.0×10^{9}	1.0×10^{10}	1.0×10^{9}
	Control	2.0×10^{12}	6.0×10^{7}	7.0×10^{7}	Erratic & Leaking	7 ——	2.0×10^{4}
G-10	1	1.3×10^{12}	9.7×10^{9}	4.0×10^{9}	1.1×10^{10}	1.5×10^{10}	1.5×10^{9}
	2	1.1×10^{12}	8.0×10^{9}	5.0×10^{9}	1.3×10^{10}	8.0×10^{9}	2.5×10^{8}
Sample G	3	1.2×10^{12}	4.0×10^{9}	3.5×10^{9}	1.5×10^{10}	1.8×10^{10}	3.0×10^{9}
	Control	1.5×10^{12}	2.8×10^{7}	4.0×10^{7}	Erratic	7.0×10^{5}	4.0×10^{4}
XXXP	1	$9\ \times10^{11}$	4.5×10^{9}	7.0×10^{9}	1.0×10^{10}	7.0×10^{9}	3.5×10^{9}
	2	$1\ \times10^{12}$	5.0×10^{9}	6.0×10^{9}	9.0×10^{9}	5.5×10^{9}	3.0×10^{9}
Sample G	3	$8\ \times10^{11}$	3.0×10^{9}	3.5×10^{9}	6.0×10^{9}	3.5×10^{9}	2.8×10^{9}
	Control	1.0×10^{12}	3.0×10^{7}	1.7×10^{8}	3.0×10^{7}	1.5×10^{9}	1.5×10^{9}
EXXXP	1	3.5×10^{12}	1.8×10^{9}	5.0×10^{9}	7.0×10^{10}	5.0×10^{10}	1.5×10^{10}
	2	3.0×10^{12}	1.8×10^{9}	5.5×10^{9}	4.5×10^{10}	3.5×10^{10}	1.0×10^{10}
Sample H	3	3.0×10^{12}	1.0×10^{9}	7.0×10^{9}	3.5×10^{10}	2.0×10^{10}	6.0×10^{9}
	Control	3.0×10^{12}	2.2×10^{8}	5.5×10^{9}	1.5×10^{8}	3.0×10^{9}	1.5×10^{9}
G-11	1	3.0×10^{12}	4.0×10^{9}	1.2×10^{10}	1.0×10^{11}	2.5×10^{11}	1.5×10^{11}
	2	3.5×10^{12}	2.0×10^{9}	1.0×10^{10}	1.1×10^{11}	3.0×10^{11}	1.5×10^{11}
Sample H	3	5.0×10^{12}	1.8×10^{9}	2.0×10^{10}	9.0×10^{10}	2.5×10^{11}	1.5×10^{11}
	Control	4.5×10^{12}	2.0×10^{7}	7.0×10^{7}	2.5×10^{8}	4.0×10^{7}	1.0×10^{6}
GF	1	2.5×10^{12}	2.0×10^{8}	5.0×10^{9}	7.0×10^{9}	8.0×10^{9}	5.0×10^{9}
	2	3.0×10^{12}	3.5×10^{8}	7.5×10^{9}	9.0×10^{9}	6.0×10^{9}	5.0×10^{9}
Sample H	3	3.0×10^{12}	1.5×10^{8}	9.0×10^{9}	1.0×10^{10}	7.0×10^{9}	6.0×10^{9}
	Control	3.0×10^{12}	1.0×10^{7}	7.0×10^{7}	2.0×10^{7} Erratic	Erratic	1.0×10^{7}
XXXP	1	3.0×10^{12}	1.8×10^{9}	1.3×10^{10}	2.7×10^{10}	6.0×10^{10}	4.0×10^{10}
	2	3.5×10^{12}	1.9×10^{9}	1.2×10^{10}	3.0×10^{9}	6.0×10^{10}	3.5×10^{10}
Sample H	3	3.5×10^{12}	1.2×10^{9}	1.0×10^{10}	1.7×10^{10}	6.0×10^{10}	3.5×10^{10}
	Control	3.5×10^{12}	2.0×10^{7}	2.5×10^{7}	9.0×10^{9}	1.0×10^{10}	Leaky
G-10	1	3.0×10^{12}	1.1×10^{9}	2.0×10^{9}	2.0×10^{9}	5.0×10^{10}	3.0×10^{10}
	2	4.0×10^{12}	1.0×10^{9}	1.5×10^{9}	1.3×10^{9}	3.0×10^{10}	2.2×10^{10}
Sample H	3	2.0×10^{12}	1.0×10^{9}	1.5×10^{9}	1.3×10^{9}	3.5×10^{10}	2.0×10^{10}
	Control	3.0×10^{12}	1.0×10^{7}	1.5×10^{7}	3.0×10^{6}	7.0×10^{9}	5.0×10^{6}

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
XXXP	1	$2.5x10^{12}$	$3.5x10^{11}$	$1.2x10^{11}$	$1.0x10^{11}$	$1.5x10^{11}$	$6.0x10^{10}$
	2	$3.0x10^{12}$	$4.0x10^{11}$	$1.3x10^{11}$	$1.1x10^{11}$	$1.5x10^{11}$	$3.0x10^{10}$
Sample I	3	$3.0x10^{12}$	$1.5x10^{11}$	$1.0x10^{11}$	$1.0x10^{11}$	$1.0x10^{11}$	$4.5x10^{10}$
	Control	$3.0x10^{12}$	$8.0x10^{8}$	$4.0x10^{7}$	$5.5x10^{7}$	$7.0x10^{7}$	$1.8x10^{7}$
EXXXP	1	$3.5x10^{12}$	$3.0x10^{11}$	$8.0x10^{10}$	$6.0x10^{10}$	$3.5x10^{10}$	$1.0x10^{10}$
	2	$3.0x10^{12}$	$2.0x10^{11}$	$6.0x10^{10}$	$5.0x10^{10}$	$2.5x10^{10}$	$7.5x10^{9}$
Smaple I	3	$3.0x10^{12}$	$1.1x10^{11}$	$2.2x10^{10}$	$2.2x10^{10}$	$1.8x10^{10}$	$5.0x10^{9}$
	Control	$4.0x10^{12}$	$6.0x10^{8}$	$8.0x10^{7}$	$3.5x10^{7}$	$1.0x10^{10}$	$1.2x10^{8}$
G-10	1	$5.0x10^{11}$	$4.5x10^{11}$	$3.0x10^{10}$	$1.5x10^{9}$	$4.0x10^{11}$	$2.0x10^{11}$
	2	$4.0x10^{11}$	$6.0x10^{11}$	$5.0x10^{11}$	$3.0x10^{11}$	$5.0x10^{11}$	$2.0x10^{11}$
Sample I	3	$4.0x10^{11}$	$3.5x10^{11}$	$5.0x10^{11}$	$3.0x10^{8}$	$2.0x10^{8}$	$7.0x10^{7}$
	Control	$8.5x10^{12}$	$1.5x10^{8}$	$1.5x10^{8}$	$4.0x10^{10}$	$1.8x10^{10}$	$4.0x10^{7}$
G-11	1	$2.0x10^{12}$	$7.0x10^{11}$	$3.5x10^{11}$	$2.0x10^{11}$	$3.0x10^{11}$	$1.5x10^{11}$
	2	$4.0x10^{12}$	$15.x10^{12}$	$3.0x10^{11}$	$2.0x10^{11}$	$2.5x10^{11}$	$1.0x10^{11}$
Sample I	3	$3.5x10^{12}$	$4.0x10^{12}$	$3.0x10^{11}$	$1.5x10^{11}$	$2.0x10^{11}$	$7.0x10^{10}$
	Control	$3.5x10^{12}$	$8.0x10^{7}$	$1.5x10^{8}$	$1.5x10^{7}$	$1.2x10^{8}$	$1.0x10^{7}$
GF	Control	$3.0x10^{12}$	$2.5x10^{7}$	$1.0x10^{8}$	$1.5x10^{6}$	$1.3x10^{5}$	$1.5x10^{5}$
	3	$2.0x10^{12}$	$6.0x10^{10}$	$3.0x10^{10}$	$2.5x10^{10}$	$1.1x10^{10}$	$4.0x10^{9}$
Sample I	2	$1.5x10^{12}$	$6.0x10^{11}$	$7.0x10^{10}$	$1.0x10^{11}$	$3.5x10^{11}$	$2.5x10^{10}$
	1	$1.5x10^{12}$	$4.0x10^{9}$	$1.0x10^{10}$	$4.5x10^{10}$	$2.5x10^{10}$	$1.5x10^{10}$
G-10	1	$2.0x10^{12}$	$3.0x10^{10}$	$2.5x10^{9}$	$1.5x10^{10}$	$2.0x10^{10}$	$2.5x10^{9}$
Sample AA	2	$2.0x10^{12}$	$1.0x10^{8}$	$2.0x10^{8}$	$1.8x10^{9}$	$8.0x10^{8}$	$8.0x10^{8}$
	3	$2.5x10^{12}$	$1.0x10^{12}$	$3.0x10^{10}$	$2.5x10^{10}$	$9.0x10^{9}$	$6.0x10^{9}$
	Control	$3.0x10^{12}$	$1.4x10^{5}$	$8.0x10^{6}$	$3.5x10^{3}$	$3.0x10^{3}$	$1.0x10^{3}$
EXXXP	1	$3.5x10^{12}$	$4.0x10^{11}$	$2.5x10^{10}$	$8.0x10^{10}$	$1.5x10^{10}$	$7.0x10^{9}$
	2	$3.0x10^{12}$	$3.5x10^{11}$	$2.5x10^{10}$	$6.0x10^{10}$	$1.0x10^{10}$	$7.0x10^{9}$
Sample AA	3	$3.0x10^{12}$	$2.5x10^{11}$	$2.0x10^{10}$	$6.0x10^{10}$	$1.0x10^{10}$	$6.5x10^{9}$
	Control	$3.0x10^{12}$	$4.0x10^{7}$	$9.0x10^{7}$	$8.0x10^{8}$	$1.2x10^{9}$	$6.0x10^{8}$
XXXP	1	$2.5x10^{12}$	$1.5x10^{12}$	$1.5x10^{11}$	$6.5x10^{11}$	$1.5x10^{11}$	$1.5x10^{11}$
	2	$3.0x10^{12}$	$7.0x10^{11}$	$1.5x10^{11}$	$5.5x10^{11}$	$1.3x10^{11}$	$1.3x10^{11}$
Sample AA	3	$3.0x10^{12}$	$1.2x10^{12}$	$2.0x10^{11}$	$5.0x10^{11}$	$1.3x10^{11}$	$1.3x10^{11}$
	Control	$3.5x10^{12}$	$2.0x10^{7}$	$7.0x10^{6}$	$2.0x10^{4}$	$2.0x10^{3}$	$2.0x10^{3}$
GF	1	$4.0x10^{12}$	$1.5x10^{12}$	$1.0x10^{11}$	$2.5x10^{11}$	$8.5x10^{10}$	$6.0x10^{10}$
	2	$4.0x10^{12}$	$1.5x10^{11}$	$5.0x10^{10}$	$1.5x10^{11}$	$3.5x10^{10}$	$2.5x10^{10}$
Sample AA	3	$4.0x10^{12}$	$1.3x10^{12}$	$9.0x10^{10}$	$2.5x10^{11}$	$6.0x10^{10}$	$4.0x10^{10}$
	Control	$4.5x10^{12}$	$1.5x10^{7}$	$3.5x10^{7}$	$1.0x10^{6}$	$7.5x10^{4}$	$9.0x10^{4}$
G-11	1	$4.0x10^{12}$	$3.0x10^{12}$	$5.0x10^{11}$	$5.0x10^{11}$	$3.0x10^{11}$	$3.0x10^{11}$
Sample AA	2	$4.0x10^{12}$	$2.5x10^{12}$	$4.0x10^{11}$	$5.0x10^{11}$	$4.0x10^{11}$	$2.5x10^{11}$
	3	$4.0x10^{12}$	$1.0x10^{12}$	$3.0x10^{11}$	$9.0x10^{11}$	$3.0x10^{11}$	$2.5x10^{11}$
	Control	$4.2x10^{12}$	$1.0x10^{7}$	$1.5x10^{7}$	Leaky	$7.0x10^{3}$	$6.0x10^{3}$

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11	1	4.0×10^{12}	4.0×10^{11}	1.5×10^{11}	1.5×10^{11}	1.8×10^{11}	1.0×10^{11}
	2	4.0×10^{12}	3.5×10^{11}	1.5×10^{11}	2.0×10^{11}	1.5×10^{11}	1.0×10^{11}
Sample BB	3	3.5×10^{12}	5.5×10^{11}	2.0×10^{11}	3.0×10^{11}	2.0×10^{11}	1.1×10^{11}
	Control	4.0×10^{12}	3.0×10^{7}	2.0×10^{7}	Erratic	--------	3.0×10^{6}
EXXXP	1	3.0×10^{12}	7.0×10^{11}	1.5×10^{11}	5.0×10^{11}	4.0×10^{11}	3.5×10^{11}
	2	3.0×10^{12}	9.0×10^{11}	2.0×10^{11}	5.5×10^{11}	3.0×10^{11}	3.5×10^{11}
Sample BB	3	3.0×10^{12}	1.0×10^{12}	2.0×10^{11}	6.0×10^{11}	4.0×10^{11}	3.5×10^{11}
	Control	4.0×10^{12}	3.0×10^{10}	4.0×10^{7}	2.5×10^{8}	1.4×10^{8}	5.0×10^{6}
XXXP	1	1.2×10^{12}	3.5×10^{11}	8.0×10^{10}	1.2×10^{11}	3.5×10^{10}	2.0×10^{10}
	2	1.5×10^{12}	6.0×10^{11}	8.0×10^{10}	9.0×10^{10}	2.5×10^{10}	1.5×10^{10}
Sample BB	3	1.5×10^{12}	6.0×10^{11}	1.2×10^{11}	4.0×10^{11}	1.5×10^{11}	2.0×10^{11}
	Control	2.2×10^{12}	1.0×10^{9}	3.5×10^{7}	1.8×10^{6}	1.0×10^{5}	2.0×10^{4}
G-10	1	2.5×10^{12}	6.0×10^{11}	1.2×10^{11}	2.5×10^{11}	1.5×10^{11}	8.0×10^{10}
	2	3.5×10^{12}	5.0×10^{11}	1.2×10^{11}	3.5×10^{11}	1.5×10^{11}	1.0×10^{11}
Sample BB	3	3.5×10^{12}	5.0×10^{11}	1.3×10^{11}	3.5×10^{11}	1.5×10^{11}	1.3×10^{11}
	Control	4.5×10^{12}	4.0×10^{7}	3.5×10^{7}	5.0×10^{6}	1.5×10^{6}	2.0×10^{5}
GF	1	4.0×10^{12}	7.0×10^{11}	1.5×10^{11}	4.0×10^{11}	1.3×10^{11}	9.0×10^{10}
	2	5.0×10^{12}	5.0×10^{11}	1.1×10^{11}	4.0×10^{11}	1.3×10^{11}	8.0×10^{10}
Sample BB	3	3.5×10^{12}	4.0×10^{11}	1.5×10^{11}	4.0×10^{11}	1.3×10^{11}	1.0×10^{11}
	Control	4.5×10^{12}	1.8×10^{8}	3.5×10^{7}	1.3×10^{6}	1.1×10^{7}	4.5×10^{4}
GF	1	4.5×10^{12}	1.0×10^{12}	1.1×10^{11}	3.0×10^{11}	1.5×10^{11}	1.0×10^{11}
	2	4.0×10^{12}	1.5×10^{12}	1.3×10^{11}	3.0×10^{11}	1.0×10^{11}	9.0×10^{10}
Sample CC	3	4.0×10^{12}	1.2×10^{12}	6.0×10^{10}	1.3×10^{11}	6.0×10^{10}	5.0×10^{10}
	Control	6.0×10^{12}	2.0×10^{7}	2.0×10^{7}	5.0×10^{6}	1.8×10^{7}	1.0×10^{6}
XXXD	1	6.0×10^{12}	1.5×10^{12}	2.0×10^{11}	5.5×10^{11}	2.0×10^{11}	2.0×10^{11}
	2	5.5×10^{12}	1.5×10^{12}	2.0×10^{11}	5.0×10^{11}	1.5×10^{11}	1.5×10^{11}
Sample CC	3	5.5×10^{12}	1.5×10^{5}	less than 10^{4}	--------	1.1×10^{3}	7.0×10^{3}
	Control	6×10^{12}	2.0×10^{12}	6.0×10^{11}	4.0×10^{11}	1.5×10^{11}	1.5×10^{11}
G-10	1	1.5×10^{12}	1.1×10^{12}	1.5×10^{12}	1.3×10^{12}	5.0×10^{11}	5.0×10^{11}
	2	1.0×10^{12}	1.0×10^{12}	$1.51x0^{12}$	1.1×10^{12}	5.0×10^{11}	5.0×10^{11}
Sample CC	3	1.5×10^{12}	$1.51x0^{7}$	6.0×10^{10}	2.0×10^{11}	1.9×10^{11}	2.5×10^{11}
	Control	1.5×10^{12}	2.6×10^{8}	1.7×10^{7}	1.5×10^{9}	3.0×10^{7}	5.5×10^{5}
EXXXP	1	1.5×10^{12}	1.5×10^{11}	9.0×10^{10}	9.0×10^{10}	3.0×10^{10}	2.0×10^{10}
	2	3.0×10^{12}	2.5×10^{11}	1.6×10^{11}	1.5×10^{11}	4.5×10^{10}	2.5×10^{10}
SampleCC	3	2.5×10^{12}	2.2×10^{11}	1.0×10^{11}	1.0×10^{11}	2.5×10^{10}	1.8×10^{10}
	Control	2.5×10^{12}	1.5×10^{8}	6.0×10^{9}	8.0×10^{8}	2.0×10^{9}	1.0×10^{7}
G-11	1	2.5×10^{12}	4.0×10^{11}	1.3×10^{12}	1.0×10^{12}	4.0×10^{11}	3.0×10^{11}
	2	3.0×10^{12}	4.0×10^{11}	1.2×10^{12}	1.0×10^{12}	3.5×10^{11}	3.0×10^{11}
Sample CC	3	2.5×10^{12}	4.0×10^{11}	1.0×10^{12}	9.0×10^{11}	3.5×10^{11}	2.0×10^{11}
	Control	2.5×10^{12}	5.0×10^{7}	9.0×10^{7}	7.0×10^{5}	1.3×10^{6}	1.3×10^{4}

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-10	1	3.0×10^{12}	4.0×10^{11}	1.3×10^{12}	1.3×10^{12}	3.5×10^{11}	2.5×10^{11}
	2	4.0×10^{12}	3.0×10^{11}	1.1×10^{12}	1.0×10^{12}	2.5×10^{11}	2.0×10^{11}
Sample GG	3	5.0×10^{12}	3.0×10^{11}	1.1×10^{12}	1.0×10^{12}	2.5×10^{11}	2.5×10^{11}
	Control	5.0×10^{12}	2.8×10^{7}	3.5×10^{7}	$1\ \times10^{6}$ Leaky	4.0×10^{5}	8.0×10^{4}
GF	1	4.0×10^{12}	4.0×10^{10}	8.0×10^{11}	7.0×10^{11}	2.0×10^{11}	1.5×10^{11}
	2	4.5×10^{12}	8.0×10^{11}	1.0×10^{12}	7.0×10^{11}	2.0×10^{11}	1.8×10^{11}
Sample GG	3	6.0×10^{12}	5.0×10^{11}	1.0×10^{12}	7.0×10^{11}	2.0×10^{11}	1.5×10^{11}
	Control	6.0×10^{12}	1.0×10^{7}	4.0×10^{7}	4.0×10^{8}	1.0×10^{9} Erratic	1.5×10^{9}
XXXP	1	6.0×10^{12}	2.5×10^{11}	3.0×10^{11}	2.5×10^{11}	8.0×10^{10}	4.0×10^{10}
	2	4.0×10^{12}	2.0×10^{11}	3.0×10^{11}	2.5×10^{11}	7.0×10^{10}	4.0×10^{10}
Sample GG	3	2.5×10^{12}	2.5×10^{11}	2.5×10^{11}	2.0×10^{11}	5.0×10^{10}	3.0×10^{10}
	Control	2.5×10^{12}	1.5×10^{7}	5.5×10^{7}	1.0×10^{6}	1.5×10^{6}	7.0×10^{5}
G-11	1	4.0×10^{12}	4.0×10^{11}	7.0×10^{11}	7.0×10^{11}	1.5×10^{11}	1.0×10^{11}
Sample GG	2	5.0×10^{12}	4.0×10^{11}	7.0×10^{11}	5.0×10^{11}	1.5×10^{11}	1.0×10^{11}
	3	6.0×10^{12}	5.0×10^{11}	9.0×10^{11}	7.0×10^{11}	1.8×10^{11}	9.0×10^{10}
	Control	6.0×10^{12}	1.8×10^{7}	4.0×10^{7}	2.0×10^{5}	6.0×10^{5}	1.2×10^{5}
EXXP	1	5.0×10^{12}	3.5×10^{11}	6.0×10^{11}	8.0×10^{11}	2.0×10^{11}	2.0×10^{11}
	2	5.0×10^{12}	3.5×10^{11}	5.0×10^{11}	5.0×10^{11}	1.5×10^{11}	7.0×10^{10}
Sample GG	3	4.0×10^{12}	2.5×10^{11}	4.0×10^{11}	6.0×10^{11}	2.0×10^{11}	1.0×10^{11}
	Control	5.0×10^{12}	5.5×10^{7}	8.0×10^{7}	5.0×10^{6}	--------	1.0×10^{6}
XXXD	1	3.0×10^{12}	3.0×10^{11}	6.0×10^{11}	4.0×10^{11}	1.5×10^{11}	6.0×10^{10}
Sample HH	2	3.5×10^{12}	3.0×10^{11}	7.0×10^{11}	4.0×10^{11}	1.1×10^{11}	7.0×10^{10}
	3	3.5×10^{12}	4.0×10^{11}	6.0×10^{11}	5.5×10^{11}	1.0×10^{11}	5.0×10^{10}
	Control	4.0×10^{12}	2.9×10^{7}	6.0×10^{7}	1.0×10^{5}	1.5×10^{6}	1.2×10^{6}
GF	1	6.0×10^{12}	1.5×10^{10}	6.5×10^{11}	8.0×10^{11}	2.0×10^{11}	1.1×10^{11}
	2	8.0×10^{12}	2.0×10^{11}	6.0×10^{11}	8.0×10^{11}	2.5×10^{11}	1.5×10^{11}
Sample HH	3	9.5×10^{12}	2.0×10^{11}	5.0×10^{11}	7.0×10^{11}	2.0×10^{11}	1.3×10^{11}
	Control	1.0×10^{13}	2.0×10^{8}	8.0×10^{7}	3.5×10^{8}	7.0×10^{10}	5.0×10^{10}
G-10	1	5.0×10^{12}	6.0×10^{11}	7.0×10^{11}	9.0×10^{11}	3.5×10^{11}	2.0×10^{11}
	2	6.5×10^{12}	7.0×10^{11}	1.0×10^{12}	8.0×10^{11}	4.0×10^{11}	3.0×10^{11}
Sample HH	3	7.0×10^{12}	6.0×10^{11}	9.0×10^{11}	9.0×10^{11}	3.5×10^{11}	3.0×10^{11}
	Control	1.0×10^{13}	5.0×10^{7}	1.0×10^{8}	5.0×10^{5}	1.0×10^{6}	6.0×10^{5}
G-11	1	7.0×10^{12}	4.0×10^{11}	7.0×10^{11}	6.0×10^{11}	2.5×10^{11}	1.0×10^{11}
	2	7.0×10^{12}	4.0×10^{11}	7.0×10^{11}	6.0×10^{11}	2.0×10^{11}	1.1×10^{11}
Sample HH	3	8.0×10^{12}	4.0×10^{11}	8.0×10^{11}	7.0×10^{11}	1.5×10^{11}	1.0×10^{11}
	Control	$.1\times10^{13}$	2.0×10^{8}	8.0×10^{8}	4.0×10^{7}	1.0×10^{7}	4.0×10^{6}
EXXXP	1	2.0×10^{12}	3.5×10^{11}	8.0×10^{11}	8.0×10^{11}	3.0×10^{11}	3.0×10^{11}
	2	7.0×10^{12}	3.5×10^{11}	1.0×10^{12}	8.0×10^{11}	3.0×10^{11}	3.0×10^{11}
Sample HH	3	7.5×10^{11}	1.1×10^{12}	5.0×10^{11}	6.0×10^{11}	3.5×10^{11}	2.0×10^{11}
	Control	9.5×10^{11}	3.0×10^{7}	3.0×10^{8}	5.0×10^{6}	1.5×10^{8}	3.0×10^{7}

SPECIMEN Y

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
XXXD	1	$.2\times10^{12}$	3.0×10^{11}	1.5×10^{11}	1.8×10^{11}	9.0×10^{10}	6.0×10^{10}
	2	$.3\times10^{12}$	4.0×10^{11}	2.5×10^{11}	2.2×10^{11}	1.1×10^{11}	7.0×10^{10}
Sample II	3	$.5\times10^{12}$	2.0×10^{11}	2.0×10^{11}	$18.\times10^{11}$	1.5×10^{11}	8.0×10^{10}
	Control	$1\ \times10^{12}$	2.0×10^{8}	7.5×10^{7}	Leaky	1.0×10^{7}	7.5×10^{5}
GF	1	$.5\times10^{12}$	2.5×10^{11}	1.3×10^{11}	6.0×10^{10}	1.5×10^{10}	1.1×10^{10}
	2	$.5\times10^{12}$	3.0×10^{11}	1.0×10^{11}	6.0×10^{10}	1.8×10^{10}	1.2×10^{10}
Sample II	3	$9\ \times10^{11}$	7.0×10^{10}	7.0×10^{10}	4.0×10^{10}	1.3×10^{10}	9.0×10^{9}
	Control	9.9×10^{11}	2.2×10^{7}	4.5×10^{7}	5.0×10^{5} Leaky	1.0×10^{5}	3.0×10^{4}
EXXP	1	$.2\times10^{12}$	7.0×10^{10}	5.0×10^{10}	8.0×10^{10}	2.0×10^{10}	1.5×10^{10}
	2	$.01\times10^{12}$	1.1×10^{11}	4.5×10^{10}	8.0×10^{10}	2.0×10^{10}	1.5×10^{10}
Sample II	3	$.6\times10^{12}$	7.5×10^{10}	4.0×10^{10}	6.0×10^{10}	1.8×10^{10}	1.5×10^{10}
	Control	$.6\times10^{12}$	7.0×10^{7}	9.0×10^{9}	1.5×10^{10}	8.0×10^{9}	5.0×10^{9}
G-10	1	$.3\times10^{12}$	3.0×10^{11}	4.0×10^{11}	4.0×10^{11}	2.5×10^{11}	2.5×10^{11}
	2	$1\ \times10^{12}$	4.0×10^{11}	6.0×10^{11}	6.0×10^{11}	3.5×10^{11}	3.5×10^{11}
Sample II	3	$.8\times10^{12}$	3.0×10^{11}	5.0×10^{11}	4.0×10^{9}	$4-7\times10^{9}$	3.0×10^{11} Erratic
	Control	$.8\times10^{12}$	3.5×10^{7}	1.0×10^{8}	2.0×10^{6}	2.0×10^{6}	4.5×10^{5}
G-11	1	$1\ \times10^{12}$	4.0×10^{11}	3.5×10^{11} (Erratic	3.0×10^{11}	1.8×10^{11}	1.5×10^{11}
Sample II	2	$.5\times10^{12}$	1.3×10^{9}	5.0×10^{9}	3.5×10^{11}	1.5×10^{11}	1.5×10^{11}
	3	$.1\times10^{12}$	$1\ \times10^{11}$	2.0×10^{11}	2.0×10^{11}	9.0×10^{10}	1.0×10^{11}
	Control	$9\ \times10^{11}$	2.6×10^{7}	4.5×10^{7}	$1\ \times10^{6}$ (Leaky)	2.0×10^{5}	1.2×10^{5}
G-11	1	$8\ \times10^{11}$	$1\ \times10^{11}$	1.5×10^{11}	1.1×10^{11}	6.0×10^{10}	6.0×10^{10}
	2	------	------	------	------	------	------
Sample GE	3	7.0×10^{11}	1.4×10^{11}	2.0×10^{11}	1.5×10^{11}	8.0×10^{10}	7.0×10^{10}
	Control	$.1\times10^{12}$	2.0×10^{8}	2.0×10^{7}	1.5×10^{7}	1.5×10^{7}	5.0×10^{7}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11 Sample A	1	3×10^{12}	2.0×10^{11}	2.0×10^{11}	6.0×10^{10}	6.5×10^{10}	4.0×10^{10}
	2	1.0×10^{12}	5.0×10^{11}	3.0×10^{11}	9.0×10^{10}	7.0×10^{10}	6.0×10^{10}
	3	1.0×10^{12}	3.0×10^{11}	2.5×10^{11}	7.0×10^{10}	7.0×10^{10}	6.0×10^{10}
	Control	1.8×10^{12}	7.0×10^{7}	3.0×10^{7}	6×10^{4}	6.0×10^{4}	2.0×10^{5}
XXXP Sample A	1	1.7×10^{12}	2.0×10^{11}	9.0×10^{10}	2.5×10^{10}	3.0×10^{10}	2.5×10^{10}
	2	$.5 \times 10^{12}$	2.5×10^{11}	1.0×10^{11}	3.0×10^{10}	3.0×10^{10}	2.5×10^{10}
	3	1×10^{12}	4.0×10^{11}	1.1×10^{11}	3.0×10^{10}	4.5×10^{10}	3.0×10^{10}
	Control	1.3×10^{2}	2.5×10^{9}	1.5×10^{9}	5.0×10^{7}	1.0×10^{8}	5.0×10^{7}
GF Sample A	1	1.0×10^{12}	1.0×10^{10}	1.2×10^{11}	2.5×10^{10}	2.5×10^{10}	2.5×10^{10}
	2	2.0×10^{12}	3.0×10^{11}	2.0×10^{11}	6.0×10^{10}	6.0×10^{10}	5.5×10^{10}
	3	$.5 \times 10^{12}$	3.0×10^{11}	2.5×10^{11}	6.0×10^{10}	8.0×10^{10}	6.0×10^{10}
	Control	1.0×10^{12}	8.0×10^{8}	3.5×10^{8}	1.0×10^{7}	2.0×10^{8}	9.0×10^{8}
G-10 Sample A	1	1.0×10^{12}	3.5×10^{11}	2.5×10^{11}	6.0×10^{10}	6.0×10^{10}	5.0×10^{10}
	2	1.3×10^{12}	4.0×10^{11}	3.0×10^{11}	6.0×10^{10}	8.0×10^{10}	7.0×10^{10}
	3	1.8×10^{12}	6.0×10^{10}	3.0×10^{11}	5.0×10^{10}	5.0×10^{10}	4.0×10^{10}
	Control	2.0×10^{12}	1.0×10^{8}	2.0×10^{8}	1.0×10^{5}	7.5×10^{5}	2.0×10^{6}
EXXXP Sample A +	1	1.0×10^{12}	1.2×10^{11}	2.0×10^{11}	4.0×10^{10}	3.0×10^{10}	3.5×10^{10}
	2	1.0×10^{12}	2.0×10^{11}	1.5×10^{11}	4.0×10^{10}	3.5×10^{10}	3.0×10^{10}
	3	1.0×10^{12}	2.5×10^{11}	1.7×10^{11}	4.0×10^{10}	3.5×10^{10}	3.0×10^{10}
	Control	2.0×10^{12}	3.0×10^{9}	7.0×10^{8}	5.0×10^{4}	3.5×10^{7}	1.0×10^{7}
EXXXP Sample C	1	1.5×10^{12}	1.5×10^{12}	3.5×10^{11}	1.5×10^{11}	1.0×10^{11}	6.0×10^{10}
	2	2.0×10^{12}	1.5×10^{12}	4.0×10^{11}	1.8×10^{11}	1.3×10^{11}	7.0×10^{10}
	3	2.0×10^{12}	1.5×10^{12}	4.0×10^{11}	1.8×10^{11}	1.5×10^{11}	7.0×10^{10}
	Control	2.2×10^{12}	2.5×10^{9}	2.0×10^{9}	1.5×10^{7}	1.0×10^{9}	2.0×10^{8}
G-10 Sample C	1	3.0×10^{12}	1.5×10^{12}	8.0×10^{11}	4.0×10^{11}	5.0×10^{11}	3.5×10^{11}
	2	2.5×10^{12}	2.0×10^{12}	8.0×10^{11}	4.0×10^{11}	4.0×10^{11}	4.0×10^{11}
	3	2.5×10^{12}	2.5×10^{12}	8.0×10^{11}	4.5×10^{11}	5.0×10^{11}	4.0×10^{11}
	Control	3.0×10^{12}	2.0×10^{7}	2.0×10^{7}	2.0×10^{5}	1.8×10^{5}	6.0×10^{4}
GF Sample C	1	6.5×10^{12}	3.5×10^{12}	6.0×10^{11}	3.5×10^{11}	3.0×10^{11}	2.5×10^{11}
	2	3.5×10^{12}	4.0×10^{12}	5.0×10^{11}	3.0×10^{11}	1.5×10^{11}	1.1×10^{11}
	3	3.0×10^{12}	2.0×10^{12}	3.0×10^{11}	1.5×10^{11}	1.0×10^{11}	8.0×10^{10}
	Control	3.0×10^{12}	1.5×10^{7}	2.2×10^{8}	3.0×10^{5}	3.0×10^{7}	3.0×10^{6}
XXXP Sample C	1	2.5×10^{12}	3.0×10^{12}	5.0×10^{11}	3.0×10^{11}	3.0×10^{11}	2.0×10^{11}
	2	2.5×10^{12}	4.5×10^{12}	6.0×10^{11}	3.0×10^{11}	3.5×10^{11}	2.5×10^{11}
	3	2.5×10^{12}	2.0×10^{12}	6.0×10^{11}	3.0×10^{11}	3.0×10^{11}	2.5×10^{11}
	Control	2×10^{12}	9.0×10^{7}	7.0×10^{7}	4.0×10^{5}	8.0×10^{6}	1.0×10^{6}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11	1	3.0×10^{12}	5.0×10^{12}	7.0×10^{11}	5.0×10^{11}	4.5×10^{11}	3.5×10^{11}
	2	3.0×10^{12}	5.0×10^{12}	3.0×10^{11}	1.5×10^{11}	1.5×10^{11}	1.3×10^{11}
Sample C	3	3.0×10^{12}	3.5×10^{12}	4.0×10^{11}	1.8×10^{11}	3.0×10^{11}	2.0×10^{11}
	Control	3.0×10^{12}	2.5×10^{8}	4.0×10^{7}	1.5×10^{6}	1.1×10^{7}	1.2×10^{6}
XXXP	1	$.5 \times 10^{12}$	3.5×10^{9}	2.0×10^{10}	2.0×10^{9}	1.0×10^{10}	8.0×10^{9}
	2	$.5 \times 10^{12}$	4.0×10^{9}	1.5×10^{10}	2.0×10^{9}	6.0×10^{11}	5.0×10^{9}
Sample D	3	$.5 \times 10^{12}$	3.7×10^{9}	1.5×10^{10}	2.1×10^{9}	9.0×10^{9}	7.0×10^{9}
	Control	1.0×10^{12}	4.0×10^{7}	less then 10^{4}	9.0×10^{4}	3.0×10^{4}	4.0×10^{4}
G-11	1	1.0×10^{12}	4.5×10^{9}	1.8×10^{10}	1.9×10^{9}	8.0×10^{9}	7.0×10^{9}
	2	1.0×10^{12}	4.5×10^{9}	1.8×10^{10}	2.5×10^{9}	8.0×10^{9}	8.0×10^{9}
Sample D	3	2.0×10^{12}	5.5×10^{9}	2.0×10^{10}	3.0×10^{9}	1.0×10^{10}	1.0×10^{10}
	Control	2.0×10^{12}	3.5×10^{7}	3.5×10^{7}	4.0×10^{4}	1.1×10^{5}	2.0×10^{4}
G-10	1	4.0×10^{11}	4.5×10^{9}	1.8×10^{10}	2.1×10^{9}	8.0×10^{9}	6.0×10^{9}
	2	$.5 \times 10^{12}$	4.0×10^{9}	2.2×10^{10}	3.0×10^{9}	1.1×10^{10}	9.0×10^{9}
Sample D	3	1.0×10^{12}	4.5×10^{9}	2.0×10^{10}	3.0×10^{9}	1.1×10^{10}	8.0×10^{9}
	Control	1.0×10^{12}	2.5×10^{7}	4.0×10^{7}	1.0×10^{5}	1.3×10^{5}	9.5×10^{4}
GF	1	$.2 \times 10^{12}$	5.0×10^{9}	1.5×10^{10}	3.0×10^{9}	9.0×10^{9}	7.0×10^{9}
	2	$.2 \times 10^{12}$	5.0×10^{9}	1.5×10^{10}	3.0×10^{9}	7.0×10^{9}	7.0×10^{9}
Sample D	3	$.2 \times 10^{12}$	5.5×10^{9}	1.5×10^{10}	3.5×10^{9}	6.0×10^{9}	7.5×10^{9}
	Control	$.5 \times 10^{12}$	4.7×10^{7}	erratic	2.0×10^{4}	2.0×10^{4}	2.0×10^{4}
EXXXP	1	3.5×10^{12}	7.0×10^{9}	2.5×10^{10}	4.8×10^{9}	9.0×10^{9}	8.0×10^{9}
	2	2.0×10^{12}	6.0×10^{9}	2.0×10^{10}	3.5×10^{9}	8.0×10^{9}	6.0×10^{9}
Sample D	3	2.0×10^{12}	5.5×10^{9}	1.8×10^{10}	3.5×10^{9}	1.0×10^{10}	7.0×10^{9}
	Control	2.0×10^{12}	1.0×10^{9}	5.0×10^{8}	5.0×10^{5} (erratic)	7.0×10^{5}	3.5×10^{5}
G-10	1	2.0×10^{12}	1.5×10^{10}	3.0×10^{10}	6.0×10^{9}	1.1×10^{10}	9.0×10^{9}
	2	1.5×10^{12}	1.3×10^{10}	2.2×10^{10}	6.0×10^{9}	1.0×10^{10}	8.0×10^{9}
Sample E	3	1.5×10^{12}	1.5×10^{10}	2.0×10^{10}	5.5×10^{9}	9.0×10^{9}	8.0×10^{9}
	Control	1.5×10^{12}	1.3×10^{7}	5.0×10^{7}	5×10^{5} (leaky)	1.5×10^{5} (leaky)	leaky
EXXXP	1	2.0×10^{12}	1.5×10^{10}	2.1×10^{10}	7.0×10^{9}	8.0×10^{9}	6.0×10^{9}
	2	2.0×10^{12}	1.7×10^{10}	2.5×10^{10}	8.0×10^{9}	1.0×10^{10}	7.0×10^{9}
Sample E	3	3.0×10^{12}	1.5×10^{10}	2.0×10^{10}	6.5×10^{9}	8.0×10^{9}	6.0×10^{9}
	Control	3.0×10^{12}	2.5×10^{8}	8.0×10^{7}	4.0×10^{5}	3.5×10^{4}	8.0×10^{4}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
XXXP Sample E	1	2.5×10^{12}	1.3×10^{10}	2.1×10^{10}	8.0×10^{9}	1.0×10^{10}	9.0×10^{9}
	2	2.0×10^{12}	1.3×10^{10}	2.2×10^{10}	8.0×10^{9}	1.0×10^{10}	9.0×10^{9}
	3	$.9\times10^{12}$	1.0×10^{10}	1.5×10^{10}	5.0×10^{9}	8.0×10^{9}	6.0×10^{9}
	Control	1.5×10^{12}	4.0×10^{7}	less then 10^{4}	9.0×10^{3}	7.0×10^{3}	5.0×10^{3}
G-11 Sample E	1	2.0×10^{12}	1.5×10^{10}	2.5×10^{10}	9.0×10^{9}	1.1×10^{10}	1.1×10^{10}
	2	2.0×10^{12}	9.0×10^{9}	1.5×10^{10}	5.0×10^{9}	9.0×10^{9}	5.5×10^{9}
	3	2.5×10^{12}	1.2×10^{10}	2.0×10^{10}	7.0×10^{9}	1.0×10^{10}	9.0×10^{10}
	Control	1.0×10^{12}	5.0×10^{7}	less then 10^{4}	1.0×10^{4}	4.0×10^{4}	5.0×10^{4}
GF Sample E	1	1.5×10^{12}	2.5×10^{10}	2.5×10^{10}	7.0×10^{9}	9.0×10^{9}	1.5×10^{10}
	2	1.5×10^{12}	1.5×10^{10}	1.8×10^{10}	6.0×10^{9}	7.0×10^{9}	1.0×10^{10}
	3	1.0×10^{12}	1.7×10^{10}	2.0×10^{10}	6.0×10^{9}	6.0×10^{9}	1.2×10^{10}
	Control	1.0×10^{12}	1.0×10^{7}	3.5×10^{7}	5.0×10^{4}	5.0×10^{4}	1.3×10^{4}
G-10 Sample F	1	1.5×10^{12}	3.0×10^{11}	3.5×10^{11}	2.0×10^{11}	2.0×10^{11}	4.0×10^{11}
	2	1.0×10^{12}	1.8×10^{11}	2.0×10^{11}	1.0×10^{11}	1.0×10^{11}	2.5×10^{11}
	3	$.5\times10^{12}$	1.1×10^{11}	1.5×10^{11}	9.0×10^{10}	8.0×10^{10}	2.0×10^{11}
	Control	1.0×10^{12}	8.0×10^{7}	2.0×10^{7}	2.0×10^{6}	2.0×10^{6}	1.5×10^{6}
GF Sample F	1	1.0×10^{12}	1.3×10^{11}	1.8×10^{11}	1.0×10^{11}	1.0×10^{11}	3.0×10^{11}
	2	1.5×10^{12}	2.0×10^{11}	2.5×10^{11}	1.5×10^{11}	1.5×10^{11}	3.0×10^{11}
	3	1.3×10^{12}	2.5×10^{11}	2.8×10^{11}	1.5×10^{11}	1.5×10^{11}	3.0×10^{11}
	Control	$.9\times10^{12}$	3.0×10^{7}	less then 10^{4}	1.0×10^{4}	1.0×10^{4}	3.0×10^{4}
XXXP Sample F	1	$.8\times10^{12}$	1.3×10^{11}	1.0×10^{11}	5.0×10^{10}	5.0×10^{10}	1.0×10^{11}
	2	$.6\times10^{12}$	1.5×10^{11}	1.2×10^{11}	4.0×10^{10}	3.0×10^{10}	6.0×10^{10}
	3	$.5\times10^{12}$	1.5×10^{11}	1.0×10^{11}	4.5×10^{10}	3.0×10^{10}	5.0×10^{10}
	Control	$.1\times10^{12}$	7.0×10^{7}	less then 10^{4}	--	--	5.5×10^{4}
G-11 Sample F	1	$.01\times10^{12}$	1.0×10^{11}	1.5×10^{11}	9.0×10^{10}	8.0×10^{10}	1.0×10^{11}
	2	9.9×10^{11}	1.3×10^{11}	1.8×10^{11}	1.0×10^{11}	9.0×10^{10}	1.3×10^{11}
	3	8.5×10^{11}	1.1×10^{11}	1.2×10^{11}	8.0×10^{10}	6.0×10^{10}	8.0×10^{10}
	Control	9.0×10^{11}	7.0×10^{7}	less then 10^{4}	9.0×10^{3}	2.0×10^{4}	2.0×10^{4}
EXXXD Sample F	1	9.0×10^{11}	5.0×10^{11}	7.0×10^{10}	5.0×10^{10}	3.0×10^{10}	2.0×10^{10}
	2	9.5×10^{11}	1.5×10^{11}	1.5×10^{11}	9.0×10^{10}	6.0×10^{10}	3.0×10^{10}
	3	8.0×10^{11}	1.2×10^{11}	1.3×10^{11}	9.0×10^{10}	5.0×10^{10}	3.0×10^{10}
	Control	8.0×10^{11}	5.0×10^{7}	less then 10^{4}	6.0×10^{4}	6.0×10^{4}	1.4×10^{4}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-10 Sample G	1	3.5×10^{12}	7.5×10^{9}	1.5×10^{10}	1.5×10^{9}	1.5×10^{10}	2.0×10^{9}
	2	3.0×10^{12}	8.5×10^{9}	1.4×10^{10}	2.0×10^{9}	1.0×10^{10}	2.5×10^{9}
	3	3.0×10^{12}	1.1×10^{10}	1.5×10^{10}	2.2×10^{9}	2.0×10^{10}	3.0×10^{9}
	Control	3.0×10^{12}	3.5×10^{7}	1.0×10^{4}	1.0×10^{4}	4.0×10^{5}	4.6×10^{4}
EXXXP Sample G	1	3.0×10^{12}	9.0×10^{11}	8.5×10^{9}	1.3×10^{9}	8.0×10^{9}	2.0×10^{9}
	2	3.0×10^{12}	7.0×10^{9}	7.5×10^{9}	1.2×10^{9}	6.0×10^{9}	1.7×10^{9}
	3	4.5×10^{12}	5.0×10^{9}	4.5×10^{9}	4.0×10^{8}	5.0×10^{9}	7.0×10^{8}
	Control	4.0×10^{12}	erratic	4.0×10^{2}	1.5×10^{5}	2.0×10^{6}	5.0×10^{5}
G-11 Sample G	1	4.0×10^{12}	8.0×10^{9}	9.0×10^{9}	1.1×10^{9}	2.0×10^{10}	4.0×10^{9}
	2	4.0×10^{12}	4.8×10^{9}	9.0×10^{9}	1.0×10^{9}	2.5×10^{10}	4.0×10^{9}
	3	3.5×10^{12}	1.0×10^{10}	1.5×10^{10}	1.5×10^{9}	1.5×10^{10}	4.0×10^{9}
	Control	4.0×10^{12}	2.0×10^{7}	3.0×10^{5}	3.0×10^{4}	5.0×10^{4}	5.0×10^{4}
XXXP Sample G	1	6.5×10^{12}	9.0×10^{9}	1.5×10^{10}	2.0×10^{9}	1.5×10^{10}	5.0×10^{9}
	2	5.0×10^{12}	7.5×10^{9}	1.4×10^{10}	1.5×10^{9}	1.5×10^{10}	5.5×10^{9}
	3	5.5×10^{12}	8.0×10^{9}	1.3×10^{10}	1.1×10^{9}	2.0×10^{10}	5.5×10^{9}
	Control	4.5×10^{12}	1.0×10^{7}	5.0×10^{6}	5.0×10^{4}	5.0×10^{4}	1.0×10^{5}
GF Sample G	1	5.5×10^{12}	8.5×10^{9}	7.5×10^{9}	1.0×10^{9}	1.1×10^{10}	4.0×10^{9}
	2	4.5×10^{12}	9.0×10^{9}	7.0×10^{9}	1.5×10^{9}	6.0×10^{9}	3.0×10^{9}
	3	3.8×10^{12}	3.0×10^{9}	5.0×10^{9}	1.0×10^{9}	2.1×10^{9}	1.0×10^{9}
	Control	5.5×10^{12}	2.6×10^{7}	7.0×10^{4}	1.0×10^{4}	6.0×10^{4}	4.0×10^{5}
XXXP Sample H	1	5.0×10^{12}	5.0×10^{8}	7.5×10^{9}	3.5×10^{8}	7.0×10^{10}	3.0×10^{9}
	2	4.5×10^{12}	9.0×10^{9}	1.8×10^{10}	1.0×10^{9}	5.0×10^{10}	4.5×10^{9}
	3	4.0×10^{12}	8.0×10^{9}	9.0×10^{9}	5.0×10^{8}	6.0×10^{10}	4.5×10^{9}
	Control	--	--		--	--	--
G-10 Sample H	1	5.5×10^{12}	1.0×10^{10}	1.0×10^{11}	3.5×10^{9}	2.0×10^{11}	2.5×10^{10}
	2	2.5×10^{12}	7.0×10^{8}	1.5×10^{10}	3.0×10^{8}	3.5×10^{11}	5.0×10^{9}
	3	3.0×10^{12}	4.0×10^{9}	4.5×10^{10}	1.2×10^{9}	3.0×10^{11}	1.5×10^{10}
	Control	4.0×10^{12}	1.1×10^{7}	1.5×10^{5}	2.0×10^{4}	1.8×10^{5}	7.0×10^{4}
EXXXP Sample H	1	4.0×10^{12}	4.0×10^{8}	3.0×10^{10}	1.0×10^{9}	1.5×10^{11}	5.0×10^{9}
	2	4.0×10^{12}	2.0×10^{8}	2.0×10^{9}	1.0×10^{8}	6.0×10^{10}	1.0×10^{9}
	3	3.0×10^{12}	2.0×10^{8}	2.5×10^{9}	1.5×10^{8}	3.0×10^{10}	1.0×10^{9}
	Control	4.0×10^{12}	2.5×10^{7}	4.0×10^{8}	3.0×10^{5}	3.0×10^{5}	1.0×10^{4}
GF Sample H	1	4.5×10^{12}	3.5×10^{8}	1.0×10^{10}	4.5×10^{8}	8.0×10^{10}	4.0×10^{9}
	2	4.0×10^{12}	5.0×10^{8}	1.0×10^{10}	5.0×10^{8}	8.0×10^{10}	5.0×10^{9}
	3	3.5×10^{12}	7.0×10^{8}	2.0×10^{10}	9.0×10^{8}	1.5×10^{11}	1.0×10^{10}
	Control	4.5×10^{12}	3.5×10^{7}	1.0×10^{6}	5.0×10^{5}	--	9.0×10^{4}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11 Sample H	1	4.0×10^{12}	1.0×10^{8}	4.0×10^{9}	1.8×10^{8}	7.0×10^{9}	1.1×10^{9}
	2	4.0×10^{12}	2.2×10^{8}	2.5×10^{9}	1.5×10^{8}	7.0×10^{9}	1.2×10^{9}
	3	4.0×10^{12}	5.0×10^{8}	4.0×10^{9}	2.0×10^{8}	1.1×10^{10}	2.0×10^{9}
	Control	5.5×10^{12}	2.5×10^{7}	9.0×10^{5}	2.0×10^{4}	5.0×10^{4}	5.0×10^{4}
XXXP Sample I	1	6.0×10^{12}	1.5×10^{11}	9.0×10^{10}	3.0×10^{10}	7.0×10^{10}	3.0×10^{10}
	2	3.5×10^{12}	1.0×10^{11}	6.0×10^{10}	2.0×10^{10}	4.0×10^{10}	2.0×10^{10}
	3	4.5×10^{12}	5.0×10^{10}	7.0×10^{10}	2.5×10^{10}	5.0×10^{10}	3.0×10^{10}
	Control	5.0×10^{12}	2.0×10^{7}	1.5×10^{5}	1.0×10^{4}	3.0×10^{4}	5.0×10^{4}
G-11 Sample I	1	3.5×10^{12}	1.5×10^{10}	1.3×10^{11}	4.0×10^{10}	3.5×10^{11}	1.5×10^{11}
	2	3.0×10^{12}	1.1×10^{11}	2.5×10^{11}	7.0×10^{10}	2.0×10^{11}	7.0×10^{10}
	3	3.0×10^{12}	5.0×10^{11}	6.0×10^{11}	2.5×10^{11}	3.0×10^{11}	2.0×10^{11}
	Control	3.5×10^{12}	1.0×10^{8}	1.0×10^{7}	2.0×10^{6}	1.5×10^{8}	2.0×10^{6}
G-10 Sample I	1	4.0×10^{12}	5.0×10^{11}	5.0×10^{11}	1.0×10^{11}	4.0×10^{11}	erratic
	2	4.0×10^{12}	7.0×10^{11}	6.0×10^{11}	2.5×10^{11}	4.0×10^{11}	2.0×10^{11}
	3	4.0×10^{12}	8.0×10^{11}	6.0×10^{11}	2.5×10^{11}	4.0×10^{11}	1.5×10^{11}
	Control	2.5×10^{12}	8.0×10^{9}	3.0×10^{11}	7.0×10^{9}	3.0×10^{11}	5.0×10^{10} (leaky)
EXXXP Sample I	1	3.5×10^{12}	2.5×10^{12}	2.0×10^{11}	8.0×10^{10}	8.0×10^{10}	3.5×10^{10}
	2	3.8×10^{12}	1.5×10^{12}	1.5×10^{11}	6.0×10^{10}	8.0×10^{10}	2.5×10^{10}
	3	4.0×10^{12}	1.4×10^{12}	1.4×10^{11}	6.0×10^{10}	8.0×10^{10}	3.0×10^{10}
	Control	4.5×10^{12}	2.5×10^{8}	2.0×10^{8}	6.0×10^{7}	1.8×10^{8}	3.0×10^{7}
GF Sample I	1	4.1×10^{12}	4.0×10^{12}	8.0×10^{11}	2.5×10^{11}	4.0×10^{11}	2.5×10^{11}
	2	4.7×10^{12}	4.5×10^{12}	8.0×10^{11}	3.0×10^{11}	4.0×10^{11}	2.5×10^{11}
	3	4.8×10^{12}	3.0×10^{12}	5.0×10^{11}	1.8×10^{11}	2.5×10^{11}	2.0×10^{11}
	Control	5.0×10^{12}	2.4×10^{7}	less then 10^{4}	2.0×10^{4}	2.0×10^{4}	6.5×10^{4}
G-11 Sample AA	1	5.0×10^{12}	1.5×10^{12}	2.5×10^{11}	4.5×10^{10}	1.0×10^{11}	4.0×10^{10}
	2	4.0×10^{12}	3.0×10^{12}	5.0×10^{11}	3.1×10^{11}	3.0×10^{11}	2.5×10^{11}
	3	4.5×10^{12}	4.0×10^{12}	8.0×10^{11}	5.0×10^{11}	4.0×10^{11}	3.0×10^{11}
	Control	5.0×10^{12}	8.0×10^{7}	2.0×10^{8}	5.0×10^{4}	1.8×10^{8}	1.0×10^{7}
GF Sample AA	1	4.5×10^{12}	4.0×10^{12}	8.0×10^{11}	5.0×10^{11}	5.0×10^{11}	4.0×10^{11}
	2	5.0×10^{12}	[illegible]$.0 \times 10^{12}$	8.0×10^{11}	6.0×10^{11}	6.0×10^{11}	5.0×10^{11}
	3	5.5×10^{12}	7.0×10^{12}	8.0×10^{11}	6.0×10^{11}	6.0×10^{11}	5.0×10^{11}
	Control	6.0×10^{12}	1.5×10^{7}	3.5×10^{7}	9×10^{4}	1.1×10^{5}	1.5×10^{5}
G-10 Sample AA	1	7.0×10^{12}	7.5×10^{12}	3.5×10^{11}	3.0×10^{11}	4.0×10^{11}	1.0×10^{8}
	2	6.5×10^{12}	8.0×10^{12}	8.0×10^{11}	5.0×10^{11}	5.0×10^{11}	4.0×10^{11}
	3	6.5×10^{12}	7.0×10^{12}	9.0×10^{11}	5.0×10^{11}	5.0×10^{11}	3.5×10^{11}
	Control	6.0×10^{12}	1.0×10^{9}	1.1×10^{7}	2.0×10^{6}	1.0×10^{6}	9.0×10^{5}

SPECIMEN X

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
EXXXP	1	5.8×10^{12}	2.5×10^{12}	3.0×10^{11}	8.0×10^{10}	1.5×10^{11}	4.0×10^{10}
	2	6.0×10^{12}	3.5×10^{12}	3.0×10^{11}	1.0×10^{11}	1.2×10^{11}	5.0×10^{10}
Sample AA	3	5.8×10^{12}	4.5×10^{12}	4.5×10^{11}	1.5×10^{11}	2.0×10^{11}	7.0×10^{10}
	Control	6.0×10^{12}	8.0×10^{7}	2.0×10^{8}	1.0×10^{5}	1.2×10^{5}	1.6×10^{5}
XXXP	1	6.2×10^{12}	3.5×10^{12}	3.5×10^{8}	1.0×10^{8}	1.0×10^{8}	5.0×10^{7}
	2	6.5×10^{12}	3.0×10^{12}	2.2×10^{11}	1.0×10^{11}	2.0×10^{11}	8.0×10^{10}
Sample AA	3	6.0×10^{12}	4.0×10^{12}	2.5×10^{11}	1.5×10^{11}	1.1×10^{11}	8.0×10^{10}
	Control	5.5×10^{12}	1.2×10^{7}	less then 10^{4}	1.2×10^{3}	1.3×10^{3}	1.5×10^{3}
GF	1	9.9×10^{12}	3.0×10^{12}	3.0×10^{11}	1.5×10^{11}	2.0×10^{11}	1.0×10^{11}
	2	5.5×10^{12}	4.5×10^{12}	4.0×10^{11}	2.0×10^{11}	2.0×10^{11}	1.5×10^{11}
Sample BB	3	6.0×10^{12}	4.0×10^{12}	3.5×10^{11}	2.0×10^{11}	2.0×10^{11}	1.2×10^{11}
	Control	5.5×10^{12}	7.0×10^{8}	1.5×10^{9}	4.0×10^{8}	2.0×10^{9}	4.0×10^{8}
G-11	1	7.0×10^{12}	1.5×10^{13}	8.0×10^{11}	3.5×10^{11}	4.0×10^{11}	1.5×10^{11}
	2	6.0×10^{12}	1.5×10^{13}	9.0×10^{11}	4.0×10^{11}	5.0×10^{11}	2.0×10^{11}
Sample BB	3	6.0×10^{12}	1.5×10^{13}	4.0×10^{11}	2.5×10^{11}	3.0×10^{11}	1.5×10^{11}
	Control	6.0×10^{12}	7.0×10^{10}	1.0×10^{9}	4.0×10^{7}	1.5×10^{8}	5.0×10^{7}
XXXP	1	6.0×10^{12}	7.5×10^{12}	6.5×10^{11}	3.0×10^{11}	4.0×10^{11}	2.0×10^{11}
	2	6.5×10^{12}	9.0×10^{12}	7.0×10^{11}	2.5×10^{11}	4.0×10^{11}	2.0×10^{11}
Sample BB	3	6.5×10^{12}	6.0×10^{12}	5.0×10^{11}	2.5×10^{11}	3.0×10^{11}	1.5×10^{11}
	Control	6.0×10^{12}	8.5×10^{10}	9.0×10^{9}	1.5×10^{8}	4.0×10^{8}	2.0×10^{8}
EXXXP	1	6.0×10^{12}	5.0×10^{12}	4.0×10^{10}	2.0×10^{9}	5.0×10^{10}	1.5×10^{10}
	2	5.5×10^{12}	4.0×10^{12}	2.0×10^{11}	9.0×10^{10}	6.0×10^{10}	2.0×10^{10}
Sample BB	3	6.0×10^{12}	5.5×10^{12}	2.2×10^{11}	9.0×10^{10}	5.0×10^{10}	1.8×10^{10}
	Control	5.5×10^{12}	1.5×10^{11}	4.0×10^{10}	1.0×10^{7}	2.0×10^{8}	9.0×10^{7}
G-10	1	7.2×10^{12}	1.0×10^{13}	8.5×10^{11}	3.0×10^{11}	6.0×10^{11}	4.0×10^{11}
	2	6.5×10^{12}	1.0×10^{13}	7.0×10^{11}	4.0×10^{11}	5.0×10^{11}	3.0×10^{9}
Sample BB	3	6.[illegible]$\times 10^{12}$	1.0×10^{13}	8.0×10^{11}	5.0×10^{11}	6.0×10^{11}	4.0×10^{11}
	Control	6.0×10^{12}	1.8×10^{7}	1.3×10^{8}	5.0×10^{6}	5.5×10^{4}	2.6×10^{4}
G-11	1	6.0×10^{12}	1.5×10^{13}	1.0×10^{12}	6.0×10^{11}	6.0×10^{11}	4.0×10^{11}
	2	4.0×10^{12}	1.0×10^{12}	6.5×10^{11}	3.0×10^{11}	4.0×10^{11}	2.5×10^{11}
Sample CC	3	4.0×10^{12}	1.0×10^{12}	7.0×10^{11}	3.0×10^{11}	4.0×10^{11}	2.5×10^{11}
	Control	4.0×10^{12}	5.0×10^{7}	less then 10^{4}	--	1.2×10^{5}	1.1×10^{5}
G-10	1	4.0×10^{12}	1.5×10^{12}	5.0×10^{11}	3.5×10^{11}	4.0×10^{11}	2.5×10^{11}
	2	4.0×10^{12}	1.3×10^{12}	5.0×10^{11}	4.0×10^{11}	5.0×10^{11}	1.5×10^{11}
Sample CC	3	4.5×10^{12}	1.5×10^{12}	5.5×10^{11}	3.0×10^{11}	4.0×10^{11}	2.0×10^{11}
	Control	5.0×10^{12}	5.0×10^{10}	3.0×10^{8}	2.0×10^{8}	2.0×10^{9}	3.0×10^{7}

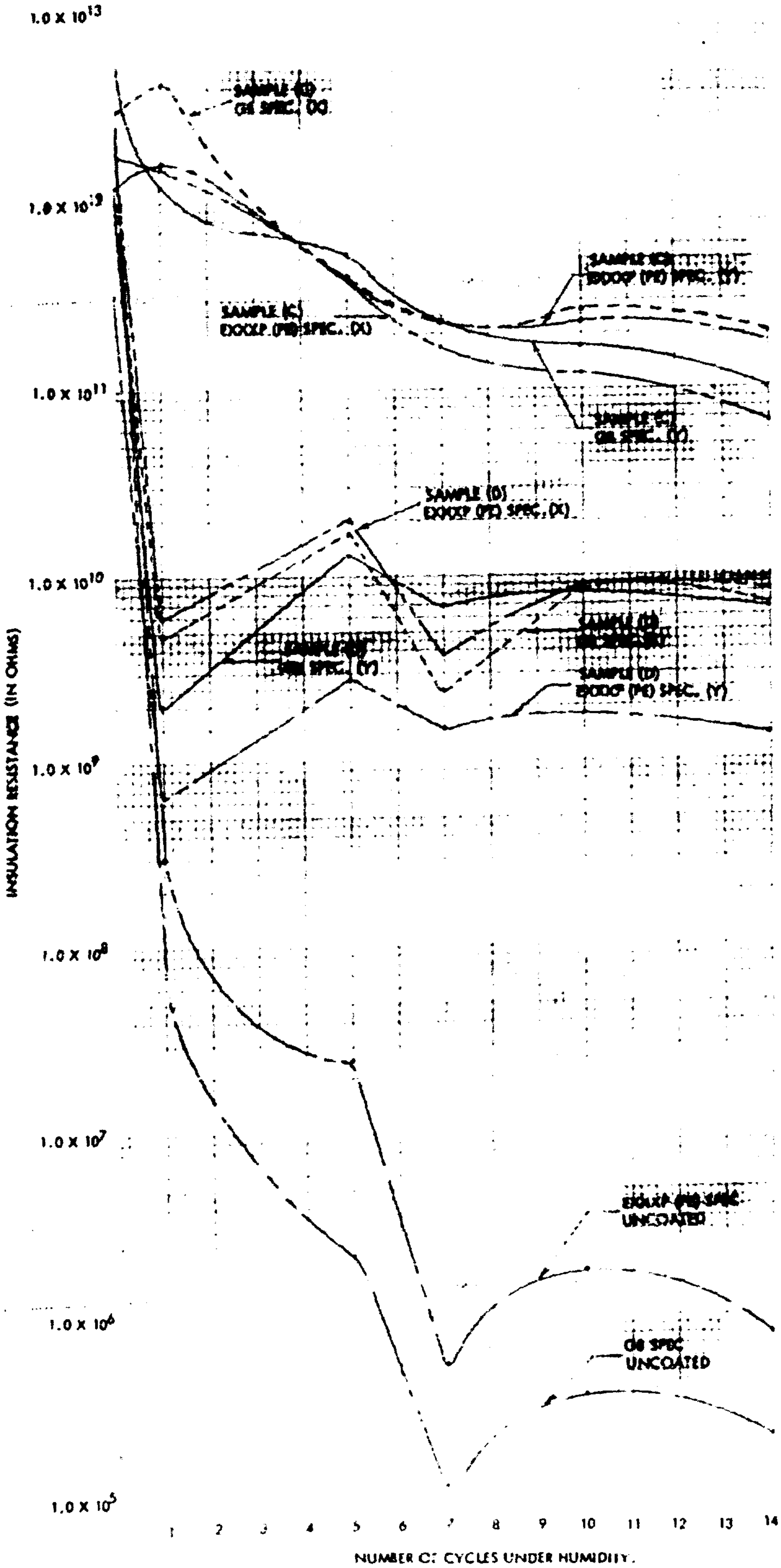
SPECIMEN Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
GF Sample CC	1	$4.5x10^{12}$	$1.1x10^{12}$	$6.0x10^{11}$	$4.0x10^{11}$	$4.0x10^{11}$	$2.5x10^{11}$
	2	$6.0x10^{12}$	$2.0x10^{12}$	$5.0x10^{11}$	$1.5x10^{11}$	$1.3x10^{11}$	$8.0x10^{10}$
	3	$6.5x10^{12}$	$1.0x10^{12}$	$5.0x10^{11}$	$2.5x10^{11}$	$3.5x10^{11}$	$2.5x10^{11}$
	Control	$6.0x10^{12}$	$2.0x10^{7}$	$1.0x10^{7}$	$5.0x10^{6}$	$1.0x10^{7}$	$1.4x10^{6}$
XXXP Sample CC	1	$6.0x10^{12}$	$2.0x10^{11}$	$1.5x10^{11}$	$8.0x10^{10}$	$1.0x10^{11}$	$4.0x10^{10}$
	2	$5.2x10^{12}$	$3.0x10^{11}$	$1.3x10^{11}$	$8.0x10^{10}$	$1.0x10^{11}$	$5.0x10^{10}$
	3	$6.5x10^{12}$	$6.0x10^{11}$	$2.0x10^{11}$	$1.0x10^{11}$	$1.5x10^{11}$	$8.0x10^{10}$
	Control	$6.0x10^{12}$	$7.0x10^{7}$	$3.0x10^{8}$	$5.0x10^{6}$	$5.0x10^{5}$	$3.0x10^{5}$
EXXXP Sample CC	1	$6.2x10^{12}$	$3.0x10^{11}$	$2.5x10^{11}$	$1.0x10^{11}$	$1.5x10^{11}$	$4.0x10^{10}$
	2	$6.5x10^{12}$	$6.0x10^{11}$	$2.0x10^{11}$	$8.0x10^{10}$	$1.0x10^{11}$	$3.5x10^{10}$
	3	$6.5x10^{12}$	$5.0x10^{11}$	$2.0x10^{11}$	$1.0x10^{11}$	$1.0x10^{11}$	$4.0x10^{10}$
	Control	$6.3x10^{12}$	$1.0x10^{8}$	Less than 10^{4}	$3.5x10^{5}$	$6.0x10^{3}$	$4.0x10^{4}$
G-10 Sample GG	1	$8.0x10^{12}$	$6.0x10^{11}$	$5.0x10^{11}$	$4.0x10^{11}$	$3.5x10^{11}$	$2.5x10^{11}$
	2	$8.0x10^{12}$	$5.0x10^{11}$	$3.0x10^{11}$	$1.8x10^{11}$	$2.0x10^{11}$	$1.5x10^{11}$
	3	$8.0x10^{12}$	$5.0x10^{11}$	$4.0x10^{11}$	$2.5x10^{11}$	$2.5x10^{11}$	$1.5x10^{11}$
	Control	$7.0x10^{12}$	$8.0x10^{7}$	less than 10^{4}	$1.5x10^{6}$	$2.0x10^{4}$	$4.0x10^{4}$
GF Sample GG	1	$8.0x10^{12}$	$7.0x10^{11}$	$2.5x10^{11}$	$1.5x10^{11}$	$1.0x10^{11}$	$7.0x10^{10}$
	2	$8.0x10^{12}$	$1.5x10^{12}$	$3.0x10^{11}$	$2.0x10^{11}$	$1.5x10^{11}$	$9.0x10^{10}$
	3	$8.0x10^{12}$	$9.0x10^{11}$	$2.5x10^{11}$	$1.8x10^{11}$	$1.1x10^{11}$	$7.0x10^{10}$
	Control	$9.0x10^{12}$	$3.5x10^{7}$	less than 10^{4}	------	$1.3x10^{5}$	$6.0x10^{4}$
G-11 SampleGG	1	$7.5x10^{12}$	$1.1x10^{12}$	$6.0x10^{12}$	$4.0x10^{11}$	$4.0x10^{11}$	$2.0x10^{11}$
	2	$7.0x10^{12}$	$8.0x10^{12}$	$5.0x10^{11}$	$2.5x10^{11}$	$3.5x10^{11}$	$1.0x10^{11}$
	3	$7.5x10^{12}$	$1.1x10^{12}$	$4.0x10^{11}$	$2.5x10^{11}$	$2.5x10^{11}$	$1.5x10^{11}$
	Control	$8.0x10^{12}$	$1.2x10^{7}$	$1.5x10^{8}$	$4.5x10^{5}$	$5.0x10^{6}$	$2.4x10^{5}$
EXXXP Sample GG	1	$8.0x10^{12}$	$4.0x10^{11}$	$1.0x10^{11}$	$6.0x10^{10}$	$2.5x10^{10}$	$1.0x10^{10}$
	2	$7.5x10^{12}$	$7.0x10^{11}$	$1.5x10^{11}$	$8.0x10^{10}$	$4.0x10^{10}$	$1.5x10^{10}$
	3	$8.0x10^{12}$	$6.0x10^{11}$	$1.6x10^{11}$	$1.0x10^{11}$	$5.0x10^{10}$	$1.8x10^{10}$
	Control	$7.0x10^{12}$	$1.6x10^{7}$	less than 10^{5}	$1.5x10^{5}$	$2.0x10^{5}$	$2.0x10^{7}$
XXXP Sample GG	1	$8.0x10^{12}$	$3.0x10^{11}$	$1.5x10^{11}$	$1.0x10^{11}$	$1.0x10^{11}$	$6.0x10^{10}$
	2	$8.0x10^{12}$	$7.5x10^{11}$	$4.0x10^{11}$	$2.5x10^{11}$	$2.0x10^{11}$	$1.5x10^{11}$
	3	$8.0x10^{12}$	$5.5x10^{11}$	$4.5x10^{11}$	$2.5x10^{11}$	$2.0x10^{11}$	$1.3x10^{11}$
	Control	$8.5x10^{12}$	$3.0x10^{7}$	$6.0x10^{8}$	$1.0x10^{6}$	$2.6x10^{5}$	$1.0x10^{5}$
GF Sample HH	1	$8.0x10^{12}$	$8.0x10^{11}$	$4.0x10^{11}$	$2.5x10^{11}$	$1.5x10^{11}$	$8.0x10^{10}$
	2	$8.0x10^{12}$	$6.0x10^{11}$	$2.5x10^{11}$	$1.1x10^{11}$	$1.0x10^{11}$	$5.0x10^{10}$
	3	$8.0x10^{12}$	$8.0x10^{11}$	$3.5x10^{11}$	$2.0x10^{11}$	$1.5x10^{11}$	$1.0x10^{11}$
	Control	$8.0x10^{12}$	$1.3x10^{9}$	$6.0x10^{9}$	$5.0x10^{7}$	$9.0x10^{7}$	$1.0x10^{7}$
XXXP Sample HH	1	$8.0x10^{12}$	$6.0x10^{11}$	$1.8x10^{11}$	$8.0x10^{10}$	$4.0x10^{10}$	$2.0x10^{10}$
	2	$8.5x10^{12}$	$6.0x10^{11}$	$1.5x10^{11}$	$7.0x10^{10}$	$3.5x10^{10}$	$1.5x10^{10}$
	3	$8.5x10^{12}$	$6.5x10^{11}$	$1.5x10^{11}$	$7.0x10^{10}$	$3.0x10^{10}$	$1.5x10^{10}$
	Control	$9.0x10^{12}$	$3.0x10^{7}$	less than 10^{4}	$3.0x10^{4}$	erratic	$2.7x10^{4}$

SPECIMEN

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms) initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
XXXP Sample HH	1	9.0×10^{12}	1.0×10^{12}	4.5×10^{11}	3.0×10^{11}	3.0×10^{11}	1.2×10^{11}
	2	8.5×10^{12}	2.0×10^{12}	6.0×10^{11}	3.0×10^{11}	3.0×10^{11}	1.5×10^{11}
	3	9.5×10^{12}	2.0×10^{12}	6.0×10^{11}	3.0×10^{11}	3.0×10^{11}	1.5×10^{11}
	Control	5.0×10^{12}	2.8×10^{7}	less than 10^{4}	3.0×10^{4}	1.0×10^{4}	9.0×10^{4}
G-10 Sample HH	1	7.5×10^{12}	1.5×10^{12}	9.0×10^{11}	6.0×10^{11}	6.0×10^{11}	3.0×10^{11}
	2	4.5×10^{12}	1.0×10^{12}	8.0×10^{11}	5.0×10^{11}	5.0×10^{11}	3.0×10^{11}
	3	4.2×10^{12}	5.0×10^{11}	6.0×10^{11}	2.0×10^{11}	2.5×10^{11}	1.5×10^{11}
	Control	5.2×10^{12}	5.0×10^{7}	5.0×10^{8}	1.0×10^{5}	leaky	5.0×10^{4}
G-11 Sample HH	1	5.2×10^{12}	1.1×10^{12}	1.0×10^{12}	4.5×10^{11}	6.0×10^{11}	3.0×10^{11}
	2	4.5×10^{12}	1.1×10^{12}	1.0×10^{12}	5.0×10^{11}	6.0×10^{11}	2.5×10^{11}
	3	5.1×10^{12}	1.5×10^{12}	1.2×10^{12}	6.0×10^{11}	6.0×10^{11}	3.0×10^{11}
	Control	5.0×10^{12}	9.0×10^{7}	less than 10^{4}	1.3×10^{5}	6.0×10^{4}	7.5×10^{4}
GF Sample II	1	5.0×10^{12}	3.0×10^{12}	8.0×10^{11}	4.0×10^{11}	4.0×10^{11}	3.0×10^{11}
	2	5.5×10^{12}	9.0×10^{11}	7.0×10^{11}	5.0×10^{11}	4.0×10^{11}	2.0×10^{11}
	3	5.5×10^{12}	2.5×10^{12}	9.0×10^{11}	6.0×10^{11}	5.0×10^{11}	3.0×10^{11}
	Control	5.0×10^{12}	5.0×10^{7}	erratic	5.0×10^{5}	1.2×10^{4}	2.0×10^{4}
G-10 Sample II	1	6.0×10^{12}	1.3×10^{12}	8.0×10^{11}	5.0×10^{11}	4.0×10^{11}	2.5×10^{11}
	2	9.9×10^{12}	4.0×10^{12}	7.0×10^{11}	7.0×10^{11}	4.0×10^{11}	4.0×10^{11}
	3	5.0×10^{12}	1.8×10^{12}	7.0×10^{11}	5.0×10^{11}	3.5×10^{11}	2.0×10^{11}
	Control	4.0×10^{12}	1.5×10^{8}	2.0×10^{8}	8.0×10^{5}	2.5×10^{5}	1.5×10^{5}
XXXP Sample II	1	5.0×10^{12}	3.5×10^{11}	1.1×10^{11}	5.0×10^{10}	5.0×10^{10}	7.0×10^{10}
	2	5.0×10^{12}	2.0×10^{12}	1.5×10^{11}	8.5×10^{10}	1.0×10^{11}	4.5×10^{10}
	3	5.0×10^{12}	7.0×10^{11}	1.5×10^{11}	6.0×10^{10}	5.0×10^{10}	2.0×10^{10}
	Control	5.0×10^{12}	8.0×10^{7}	less than 10^{4}	7.0×10^{4}	1.0×10^{4}	4.0×10^{4}
EXXXP Sample II	1	6.0×10^{12}	4.0×10^{11}	1.5×10^{11}	5.0×10^{10}	1.5×10^{11}	1.8×10^{10}
	2	5.5×10^{12}	8.0×10^{11}	1.5×10^{11}	5.0×10^{10}	1.0×10^{11}	1.5×10^{10}
	3	6.0×10^{12}	6.0×10^{11}	2.0×10^{11}	8.5×10^{10}	1.5×10^{11}	2.5×10^{10}
	Control	6.0×10^{12}	4.0×10^{7}	2.0×10^{8}	1.0×10^{7}	1.0×10^{7}	5.0×10^{6}
G-11 Sample II	1	6.0×10^{12}	1.0×10^{12}	8.0×10^{11}	6.0×10^{11}	1.2×10^{12}	4.0×10^{11}
	2	6.2×10^{12}	1.0×10^{12}	1.0×10^{12}	7.0×10^{11}	1.5×10^{12}	4.0×10^{11}
	3	6.2×10^{12}	9.0×10^{11}	1.0×10^{12}	5.0×10^{11}	1.3×10^{12}	4.0×10^{11}
	Control	6.0×10^{12}	5.0×10^{7}	less than 10^{4}	2.0×10^{4}	1.0×10^{4}	5.0×10^{4}
G-10 Sample GE	1	8.0×10^{12}	2.0×10^{12}	8.0×10^{11}	4.0×10^{11}	7.0×10^{11}	3.0×10^{11}
	2	4.0×10^{12}	1.5×10^{12}	7.0×10^{11}	3.5×10^{11}	6.0×10^{11}	1.5×10^{11}
	3	5.0×10^{12}	1.5×10^{12}	6.0×10^{11}	2.5×10^{11}	3.5×10^{11}	7.0×10^{11}
	Control	6.0×10^{12}	1.0×10^{12}	3.0×10^{11}	2.5×10^{11}	4.0×10^{11}	4.0×10^{11}
GF Sample GE	1	6.0×10^{12}	7.0×10^{8}	2.5×10^{9}	2.0×10^{9}	3.0×10^{9}	5.0×10^{8}
	2	5.0×10^{12}	2.0×10^{12}	8.0×10^{11}	5.0×10^{11}	8.0×10^{11}	2.5×10^{11}
	3	6.0×10^{12}	2.0×10^{11}	1.5×10^{11}	9.0×10^{10}	1.8×10^{11}	2.0×10^{10}
	Control	6.0×10^{12}	6.0×10^{7}	2.0×10^{8}	1.0×10^{7}	1.5×10^{7}	5.0×10^{6}

SPECIMEN

Laminate and Sample No.	Pattern Number	Insulation Resistance, after (in ohms)					
		initial	1st cycle	5th cycle	7th cycle	10th cycle	14th cycle
G-11	1	6.0×10^{12}	4.0×10^{12}	9.0×10^{11}	6.0×10^{11}	1.0×10^{12}	3.0×10^{11}
	2	6.0×10^{12}	3.0×10^{12}	9.0×10^{11}	6.0×10^{11}	8.[illegible]$\times 10^{11}$	2.5×10^{11}
Sample GE	3	8.0×10^{12}	3.0×10^{12}	9.0×10^{11}	6.0×10^{11}	7.0×10^{11}	2.5×10^{11}
	Control	4.0×10^{12}	5.0×10^{9}	2.0×10^{7}	1.0×10^{5}	5.0×10^{4}	3.0×10^{4}


1.0 X 10^13
1.0 X 10^12
1.0 X 10^11
1.0 X 10^10
1.0 X 10^9
1.0 X 10^8
1.0 X 10^7
1.0 X 10^6
1.0 X 10^5
INSULATION RESISTANCE (IN OHMS)
SAMPLE (D)
SAMPLE (C)
UNCOATED
GE SPEC
UNCOATED
1 2 3 4 5 6 7 8 9 10 11 12 13 14
NUMBER OF CYCLES UNDER HUMIDITY.